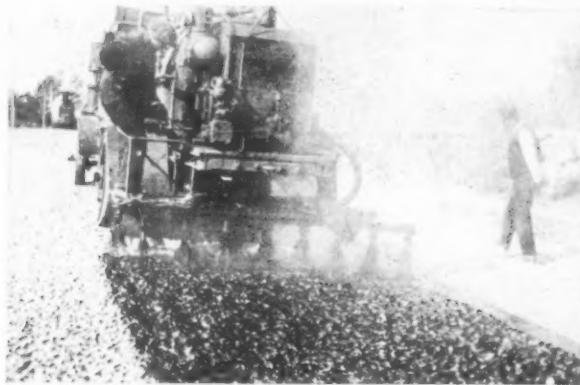


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A Purchasing Guide for Engineers, Contractors, Public Officials  
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# Where to Purchase

A comprehensive Directory of the leading machinery and supply manufacturers arranged for the convenience of contractors, engineers and public officials who may desire to secure catalogs or prices on construction equipment. Where the name of a manufacturer is preceded by a star (\*) it indicates that the user of the directory may secure further information by referring to the manufacturer's advertisement in this issue. The index to advertisers will be found on page facing the inside back cover.

## STUMPF

### ACETYLENE

Linde Air Products Co., New York.  
Prest-O-Lite Co., Inc., New York.

## GSTUMPF

### ACETYLENE APPARATUS

Oxweld Acetylene Co., Newark, N. J.

### ADDING MACHINES. (See Calculating Machines.)

### AIR COMPRESSORS

\*Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
\*Do Laval Steam Turbine Co., Trenton, N. J.  
\*Fairbanks, Morse & Co., Chicago, Ill.  
\*General Electric Co., Schenectady, N. Y.  
\*Indiana Air Pump Co., Indianapolis, Ind.  
\*Nordberg Mfg. Co., Milwaukee, Wis.  
\*Standard Scale & Supply Co., Pittsburgh, Pa.  
\*United Iron Works Co., Kansas City, Mo.  
\*Worthington Pump & Mch'y. Corp., N. Y. C.  
Cement-Gum Co., Cornell Hills, Pa.  
Chicago Pneumatic Tool Co., New York, N. Y.  
De La Vigne Machine Co., N. Y. C.  
Gardner Governor Co., Quincy, Ill.  
Hardie-Tynes Mfg. Co., Birmingham, Ala.  
Ingersoll-Rand Co., N. Y. C.  
Norwalk Iron Works Co., South Norwalk, Conn.  
Schramm & Son, Inc., Chris. D., Philadelphia, Pa.  
Stratton & Bragg Co., Petersburg, Va.  
Sullivan Mch'y. Co., Chicago, Ill.  
Westinghouse Trac. Brake Co., Wilmerding, Pa.

### ARC LAMPS

\*General Electric Co., Schenectady, N. Y.  
\*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

### ARCHITECTURAL IRON WORK

Chesapeake Iron Works, Baltimore, Md.  
Dietrich Bros., Baltimore, Md.  
Hirsch Rolling Mill Co., St. Louis, Mo.  
Snead Arch Iron Works, Louisville, Ky.  
Stewart Iron Works Co., Cincinnati, Ohio

### ARMORED CONCRETE PAVEMENTS

\*Truscon Steel Co., Youngstown, Ohio.  
Concrete Steel Co., New York.

### ARTESIAN WELL DRILLS AND PUMPS

\*Am. Well Works, Aurora, Ill.

### ARRESTOS, ETC.

\*Carey Co., Philip, Cincinnati, Ohio.  
Dominion Asbestos & Rubber Corp., N. Y. C.  
Keesbey & Mattison Co., Ambler, Pa.

### ASH HANDLING MACHINERY

\*Haisa Mfg. Co., Geo., New York  
\*Ottersen Auto Eductor Co., Springfield, O.  
Bartlett & Snow Co., C. O., Cleveland, O.  
Brown Hoisting Mach. Co., Cleveland, Ohio.  
Byers Mach. Co., J. F., Ravenna, Ohio.  
Chain Belt Co., Milwaukee, Wis.  
Gifford-Wood Co., Hudson, N. Y.  
Green Eng. Co., East Chicago, Ind.  
Guarantee Constr. Co., N. Y. C.  
Jeffrey Mfg. Co., Columbus, Ohio.  
Kilbourn & Jacob Mfg. Co., Columbus, O.  
Lakewood Eng. Co., Cleveland, O.  
Link Belt Co., Chicago, Ill.  
Portable Mch'y. Co., Passaic, N. J.  
Robins Conv. Belt Co., N. Y. C.  
Webster Mfg. Co., Chicago, Ill.

## ASPHALT

\*Barber Asphalt Paving Co., Philadelphia, Pa.  
\*Barrett Co., New York.  
\*Pioneer Asphalt Co., Lawrenceville, Ill.  
\*Standard Oil Co. of Ind., Chicago, Ill.  
\*Texas Co., N. Y. C.  
\*Warren Bros. Co., Boston, Mass.  
Atlantic Refining Co., Philadelphia, Pa.  
Gulf Refining Co., Pittsburgh, Pa.  
Headley Good Roads Co., Philadelphia, Pa.  
Sinclair Ref. Co., Chicago, Ill.  
Standard Oil Co. of N. Y., N. Y. C.  
Standard Oil Co. of N. J., Newark, N. J.  
U. S. Asphalt Refining Co., N. Y. C.

### ASPHALT KETTLES. (See Kettles for Asphalt and Tar Heating.)

## ASPHALT PLANTS, TOOLS, ETC.

\*Austin Machinery Corp'n., Chicago, Ill.  
\*Barber Asphalt Paving Co., Philadelphia, Pa.  
\*Conklin & Harrington, Inc., New York, N. Y.  
\*Warren Bros. Co., Boston, Mass.  
Cummer & Son Co., F. D., Cleveland, O.  
East Iron & Machine Co., Lima, Ohio.  
Hetherington & Berner, Indianapolis, Ind.

### ASPHALT ROLLERS. (See Road and Paving Rollers.)

## ASPHALT SURFACE HEATERS

\*Barber Asphalt Paving Co., Philadelphia, Pa.  
\*Equitable Asphalt Maint. Co., Kansas City, Mo.

## BACKFILLERS

\*Austin Machinery Corp'n., Chicago, Ill.  
\*Koehring Machine Co., Milwaukee, Wis.  
\*Pawlitz & Harnischfeger Co., Milwaukee, Wis.  
American Cement Mch'y. Co., Inc., Keokuk, Ia.  
Constr. Mch'y. Co., Waterloo, Ia.  
Oshkosh Mfg. Co., Oshkosh, Wis.  
Parsons Co., Newton, Ia.

## BAR BENDERS AND CUTTERS

\*Koehring Machine Co., Milwaukee, Wis.  
\*Ransome Concrete Machinery Co., Dunellen, N. J.  
Concrete Steel Co., New York.  
Electric Welding Co., Pittsburgh, Pa.  
Hinman & Co., D. A., Sandwich, Ill.

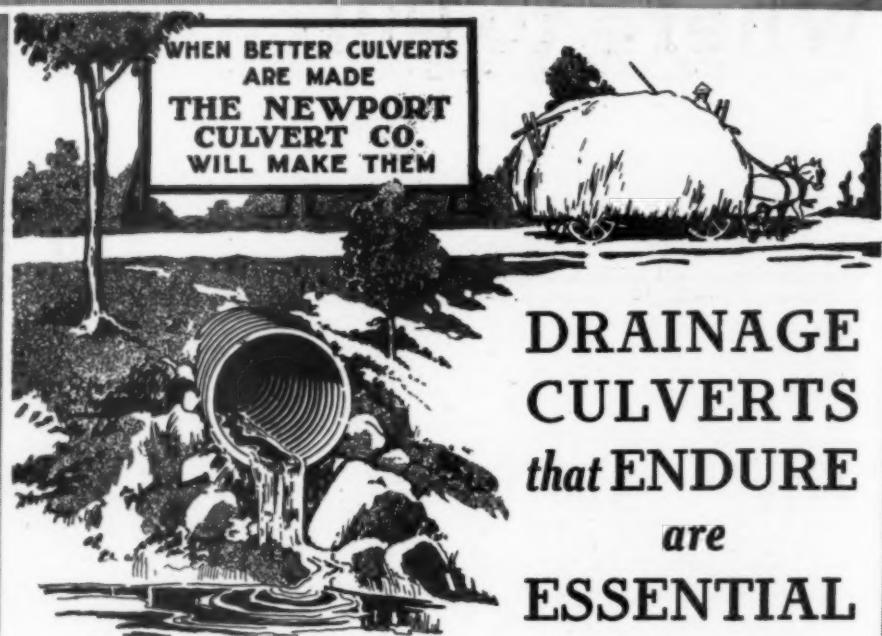
## BAR CHAIRS, REINFORCING

\*Truscon Steel Co., Youngstown, Ohio.  
Concrete Steel Co., N. Y. C.  
Universal Form Clamp Co., Chicago, Ill.

## BAES, IRON AND STEEL

Ahorn Steel Co., Inc., N. Y. C.  
Bethlehem Steel Co., So. Bethlehem, Pa.  
Carbon Steel Co., Pittsburgh, Pa.  
Carnegie Steel Co., Pittsburgh, Pa.  
Franklin Steel Works, Franklin, Pa.  
Gulf States Steel Co., Birmingham, Ala.  
Hirsch Rolling Mill Co., St. Louis, Mo.  
Illinois Steel Co., Chicago, Ill.  
Inland Steel Co., Chicago, Ill.  
Lackawanna Steel Co., Buffalo, N. Y.  
Midvale Steel & Ordnance Co., Philadelphia, Pa.  
Republic Iron & Steel Co., Youngstown, O.  
St. Louis Screw Co., St. Louis, Mo.  
Sweet's Steel Co., Williamsport, Pa.

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## Where to Purchase

5

### BELTING, RUBBER

Allen Mfg. Co., W. D., Chicago, Ill.  
Fairbanks Co., The, N. Y. C.  
Goodall Rubber Co., Inc., Philadelphia, Pa.  
Goodyear Tire & Rubber Co., Akron, O.  
McMaster-Carr Supply Co., Chicago, Ill.  
Mullenroy Co., Inc., Philadelphia, Pa.  
Pa. Rubber Co., Jeanetta, Pa.  
Republic Rubber Co., Youngstown, Ohio.  
Salisbury & Co., Inc., W. H., Chicago, Ill.  
Southern Rubber & Belt Co., Houston, Tex.  
Union Asbestos & Rubber Co., Chicago, Ill.  
Voorhees Rubber Mfg. Co., Jersey City, N. J.

### BENDING MACHINES (PIPE)

Amer. Pipe Bending Mach. Co., Boston, Mass.  
Hinman Co., D. A., Sandwich, Ill.  
Walworth Mfg. Co., Boston, Mass.

### BINS, STORAGE

\*Good Roads Mach'y Co., Philadelphia, Pa.  
\*Pittsburgh Des Moines Steel Co., Pittsburgh, Pa.  
\*Ransome Concrete Machy. Co., Dunellen, N. J.  
Berger Mfg. Co., Canton, Ohio.  
Galion Iron Works & Mfg. Co., Galion, Ohio.  
Green Engineering Co., E. Chicago, Ind.  
Petroleum Iron Works Co., Sharon, Pa.

### BLAST HOLE DRILLING MACHINES. (See "Well Drilling and Blast Hole Machines")

### BLASTING POWDER (See Explosives)

### BLOCKS AND TACKLE

Boston & Lockport Block Co., East Boston, Mass.  
Broderick & Bascom Rope Co., St. Louis, Mo.  
Dobie Fry & Mach. Co., Niagara Falls, N. Y.  
Topping Bros., N. Y. C.  
Upson-Walton Co., Cleveland, Ohio.

### BOILERS, PRESSURE

\*De Laval Steam Turbine Co., Trenton, N. J.  
\*General Electric Co., Schenectady, N. Y.  
American Blower Co., Detroit, Mich.  
American Gas Furnace Co., N. Y. C.  
Spencer Turbine Co., Hartford, Conn.

### BLUE PRINT MACHINES

\*Wickes Bros., Saginaw, Mich.  
Indianapolis Blue Print & S'ply Co., Ind'apolis.

### BLUE PRINT PAPERS

\*Kolesch & Co., New York.  
Indianapolis Blue Print & S'ply Co., Ind'apolis.

### BOILERS

Abendroth & Root Mfg. Co., Newburgh, N. Y.  
Ames Iron Works, Oswego, N. Y.  
Babcock & Wilcox Co., N. Y. C.  
Biggs Boiler Wks., Akron, Ohio.  
Cameron & Barkley Co., Charleston, S. C.  
Casey-Hedges Co., Chattanooga, Tenn.  
Chandler & Taylor Co., Indianapolis, Ind.  
Chatta. Boiler & Tank Co., Chattanooga, Tenn.  
Cole Mfg. Co., R. D., Newnan, Ga.  
Erie City Iron Works, Erie, Pa.  
Flory Mfg. Co., Bangor, Pa.  
Hartley Boiler Works, Montgomery, Ala.  
Heine Safety Boiler Co., St. Louis, Mo.  
Houston, Stanwood & Gamble Co., Cincinnati, O.  
Industrial Works, Bay City, Mich.  
Ladd Co., Geo. T., Pittsburgh, Pa.  
Loffel & Co., J., Springfield, O.  
Lombard Iron Works, Augusta, Ga.  
Lord & Burnham Co., Irvington, N. Y.  
Murray Iron Works Co., Burlington, Ia.  
New Bern Iron Wks. & Sup. Co., New Bern, N. C.  
Petroleum Iron Works Co., Sharon, Pa.  
Randle Mch'y. Co., Cincinnati, O.  
Schofield Iron Works, Macon, Ga.  
Taylor Eng'r & Mfg. Co., Allentown, Pa.  
Valk & Murdoch Co., Charleston, S. C.  
Vogt Mch'y. Co., Inc., Louisville, Ky.  
Walsh & Welders Boiler Co., Chattanooga, Tenn.

### BOLTS, NUTS, NAILS, RIVETS, SPIKES

American Screw Co., Providence, R. I.  
American Spike Co., N. Y. C.  
Ames, W. & Co., Jersey City, N. J.  
Beck & Corbitt Iron Co., St. Louis, Mo.  
Bethlehem Steel Co., Bethlehem, Pa.  
Camden Forge Co., Camden, N. J.  
Clark Bros. Bolt Co., Milldale, Conn.  
Grant, Rebt., N. Y. C.  
Hoffman & Co., R. C. Inc., Baltimore, Md.  
Inland Steel Co., Chicago, Ill.  
Larkin, J. K., N. Y. C.

Milton Mfg. Co., Milton, Pa.  
Oliver Iron & Steel Co., Pittsburgh, Pa.  
Progressive Mfg. Co., Torrington, Conn.  
Republic Iron & Steel Co., Youngstown, O.  
Rhode Island Tool Co., Providence, R. I.  
Russell, Burdall & Ward Co., Port Chester, N. Y.  
Ryerson & Son, J. T., Chicago, Ill.  
St. Louis Screw Co., St. Louis, Mo.  
Star Exp. Bolt Co., N. Y. C.  
Topping Bros., N. Y. C.  
Sweet's Steel Co., Williamsport, Pa.

### BRACES, TRENCH

\*Duff Mfg. Co., Pittsburgh, Pa.  
\*Waldo Bros. & Bond Co., Boston, Mass.  
Clow & Sons, J. B., Chicago, Ill.

### BRASS GOODS

\*Hays Mfg. Co., Erie, Pa.  
\*Mueller Mfg. Co., H. Decatur, Ill.  
\*Union Water Meter Co., Worcester, Mass.  
Glander Brass Mfg. Co., Cleveland, O.  
Haydenville Co., Haydenville, Mass.  
United Brass Mfg. Co., Cleveland, O.

### BRICK, PAVING (See Paving Brick)

### BRIDGES AND BUILDINGS, STEEL

\*Chicago Bridge & Iron Works, Chicago, Ill.  
\*Pittsburgh Des Moines Steel Co., Pittsburgh, Pa.  
American Bridge Co., N. Y. C.  
Bellfontaine Bridge & Steel Co., Bellfontaine, O.  
Belmont Iron Works, Philadelphia, Pa.  
Berlin Constr. Co., Berlin, Conn.  
Bethlehem Steel Bridge Corp., Bethlehem, Pa.  
Blaw-Knox Co., Pittsburgh, Pa.  
Boston Bridge Works, Boston, Mass.  
Central States Bridge Co., Indianapolis, Ind.  
Champion Bridge Co., Wilmington, O.  
Chesapeake Iron Works, Baltimore, Md.  
Eastern Bridge & Struc. Co., Worcester, Mass.  
Ferguson Co., H. K., Cleveland, O.  
Flour City Iron Co., Minneapolis, Minn.  
Fort Pitt Bridge Works, Pittsburgh, Pa.  
Hydraulic Steelcraft Co., Cleveland, O.  
Ingalls Iron Works, Birmingham, Ala.  
Inland Steel Co., Chicago, Ill.  
Inter. Steel & Iron Co., Evansville, Ind.  
King Bridge Co., Cleveland, O.  
Lackawanna Bridge Co., Buffalo, N. Y.  
Lewis-Hall Iron Wks., Detroit, Mich.  
Louisville Bridge & Iron Co., Louisville, Ky.  
McClintic Marshall Co., Pittsburgh, Pa.  
Milwaukee Bridge Co., Milwaukee, Wis.  
Minn. Steel & Mch'y. Co., Minneapolis, Minn.  
Missouri Vt. Bridge & Iron Co., Lawrenceburg, Kan.  
Moraw Constr. Co., Chicago, Ill.  
Mt. Vernon Bridge Co., Mt. Vernon, Ohio.  
Penn. Bridge Co., Beaver Falls, Pa.  
Richmond Struc. Steel Co., Richmond, Va.  
Riverside Bridge Co., Martins Ferry, O.  
Toledo Crane Co., Toledo, O.  
Virginia Bridge & Iron Co., Roanoke, Va.  
Wisc. Bridge & Iron Co., North Milwaukee, Wis.

### BUCKETS, AUTOMATIC DUMPING

\*Littleford Bros., Cincinnati, O.  
Lakewood Engineering Co., Cleveland, O.  
Stuebner Iron Works, G. L., Long Island City, N. Y.

### BUCKETS, CLAM SHELL

\*Austin Mach. Corp., Chicago, Ill.  
\*Haiss Mfg. Co., Geo., N. Y. C.  
\*Owen Bucket Co., Cleveland, O.  
Advance Eng. Co., Cleveland, O.  
Blaw-Knox Co., Pittsburgh, Pa.  
Brosius, E. E., Pittsburgh, Pa.  
Brown Hoisting Mch'y. Co., Cleveland, O.  
Browning Co., Cleveland, O.  
Byers Mach. Co., J. F., Ravenna, O.  
Hayward Co., N. Y. C.  
Industrial Works, Bay City, Mich.  
Klesler Co., J. F., Chicago, Ill.  
Lakewood Engineering Co., Cleveland, O.  
Link-Belt Co., Chicago, Ill.  
Orton & Steinbrenner, Chicago, Ill.  
Vulcan Iron Works, Jersey City, N. J.  
Williams Co., G. H., Erie, Pa.

### BUCKETS, CONCRETE

\*Ransome Concrete Machy. Co., Dunellen, N. J.  
\*Rochester Can Co., Rochester, N. Y.  
Insley Mfg. Co., Indianapolis, Ind.  
Lakewood Engineering Co., Cleveland, O.  
Smith Co., T. L., Milwaukee, Wis.  
Union Iron Works, Inc., Hoboken, N. J.

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## The Speed Bucket

for economical handling of crushed stone and other building materials from cars. The Type "O" Owen Bucket takes off the top of the load in less trips and cleans up the bottom in "jig" time. THE ONLY BUCKET WITH LUBRICATED AND GRIT-PROOF MAIN BEARINGS. This and other features are big repair savers. Get complete data today.

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# OWEN

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**HALF BAG**  
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Patented

**GRAY IRON  
FOUNDRY CO.**

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**QUICK EFFICIENT ECONOMICAL**

Burn Kerosene, Fuel, Crude Oils, and Distillate

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LEADING CONTRACTORS HAVE BEEN  
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PAST FIFTEEN YEARS

## Where to Purchase

7

### BUCKETS, DRAGLINE

- \*Austin Mach. Corp., Chicago, Ill.
- \*Bucyrus Co., So. Milwaukee, Wis.
- Brown Hoisting Mach. Co., Cleveland, O.
- Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
- Hayward Co., N. Y. C.
- Industrial Works, Bay City, Mich.
- Monighan Machine Co., Chicago, Ill.
- Sauermaier Bros., Chicago, Ill.

### BUCKETS, DREDGING AND EXCAVATING

- \*Austin Mach. Corp., Chicago, Ill.
- \*Bucyrus Co., So. Milwaukee, Wis.
- \*Owen Bucket Co., Cleveland, O.
- Blaw-Knox Co., Pittsburgh, Pa.
- Brown Hoisting Mach. Co., Cleveland, O.
- Browning Co., Cleveland, O.
- Hayward Co., N. Y. C.
- Inasley Mfg. Co., Indianapolis, Ind.
- Kiesler Co., J. F., Chicago, Ill.
- Lakewood Eng. Co., Cleveland, O.
- Mead-Morrison Mfg. Co., East Boston, Mass.
- Monighan Machine Co., Chicago, Ill.
- Union Iron Works, Inc., Hoboken, N. J.
- Williams Co., G. H., Erie, Pa.

### BUCKETS, ORANGE PEEL

- \*Hals Mfg. Co., Geo., N. Y. C.
- Hayward Co., New York.
- Industrial Works, Bay City, Mich.
- Kiesler Co., J. F., Chicago, Ill.
- McMyler Interstate Co., Cleveland, O.
- Mead-Morrison Mfg. Co., East Boston, Mass.
- Orton & Steinbrenner Co., Chicago, Ill.
- Vulcan Iron Works, Jersey City, N. J.

### BUILDINGS, STEEL (See Bridges and Buildings)

### BUNKS AND COTS

- Fort Pitt Bedding Co., Pittsburgh, Pa.
- Haggard & Marcusson Co., Chicago, Ill.
- Southern Rome Co., Baltimore, Md.

### CABLES (See Wire and Cables)

### CABLEWAYS

- Broderick & Bassett Rope Co., St. Louis, Mo.
- Flory Mfg. Co., B. Bangor, Pa.
- Lidgerwood Manufacturing Co., New York.
- Roebling Sons Co., J. A., Trenton, N. J.
- Sauermaier Bros., Chicago, Ill.
- Waterbury Co., N. Y. C.

### CAISSENS

- American Bridge Co., N. Y. C.
- Foundation Co., N. Y. C.
- Lackawanna Steel Co., Buffalo, N. Y.
- O'Rourke Eng. Constr. Co., N. Y. C.
- Petroleum Iron Works Co., Sharon, Pa.

### CALCULATING MACHINES

- \*Monroe Calculating Machine Co., Orange, N. J.
- Marchant Calc. Machine Co., Oakland, Cal.

### CARS, INDUSTRIAL V. DUMPING

- \*Austin Mach. Corp., Chicago, Ill.
- \*Koppel Ind. Car & Eq. Co., Koppel, Pa.
- \*United Iron Works, Kansas City, Mo.
- Atlas Car & Mfg. Co., Cleveland, O.
- Chase Fdry. & Mfg. Co., Columbus, O.
- Easton Car & Constr. Co., N. Y. C.
- Inasley Mfg. Co., Indianapolis, Ind.
- Kilbourne & Jacobs Mfg. Co., Columbus, O.
- Lakewood Engineering Co., Cleveland, O.
- Oliver Mfg. Co., W. J., Knoxville, Tenn.
- Stuehner Iron Works, G. L., Long Island City, N. Y.
- Whiting Corp'n, Harvey, Ill.

### CARTS, CONCRETE

- \*Gray Iron Fdry. Co., Reading, Pa.
- \*Lee Trailer & Body Co., Chicago, Ill.
- \*Littleford Bros., Cincinnati, O.
- \*Ransome Concrete Machy. Co., Dunellen, N. J.
- \*Standard Scale & Supply Co., Pittsburgh, Pa.
- Etnyre & Co., E. D., Oregon, Ill.
- Inasley Mfg. Co., Indianapolis, Ind.

\* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.

- Kilbourne & Jacobs Mfg. Co., Columbus, O.
- Lakewood Engineering Co., Cleveland, O.
- Smith Co., T. L., Milwaukee, Wis.
- Sterling Wheelbarrow Co., Milwaukee, Wis.
- Toledo Wheelbarrow Co., Toledo, Ohio.

### CAST IRON PIPE (See Pipe, Cast Iron)

### CASTINGS, IRON AND STEEL

- \*American Cast Iron Pipe Co., Birmingham, Ala.
- \*Central Fdry. Co., N. Y. C.
- \*Clark Co., H. W., Mattoon, Ill.
- \*Gray Iron Fdry. Co., Reading, Pa.
- \*Lynchburg Fdry. Co., Lynchburg, Va.
- \*U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.
- \*Warren Fdry. & Mach. Co., N. Y. C.
- Camden Iron Works, Camden, N. J.
- Flower Valve Mfg. Co., Detroit, Mich.
- Glamorgan Pipe & Foundry Co., Lynchburg, Va.
- Jurrey Mfg. Co., Columbus, O.
- Marion Malleable Iron Works, Marion, Ind.
- Pechstein Iron Works, Keokuk, Iowa.
- Sessions Fdry. Co., Bristol, Conn.
- Speidel, J. G., Reading, Pa.

### CASTINGS, STREET AND SEWER

- \*Central Fdry. Co., N. Y. C.
- \*Doe Co., W. E., Chicago, Ill.
- \*Lynchburg Fdry. Co., Lynchburg, Va.
- \*U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.
- Casey-Hedges Co., Chattanooga, Tenn.
- Clow & Sons, J. B., Chicago, Ill.
- Pechstein Iron Works, Keokuk, Ia.

### CATCH BASINS AND MANHOLE COVERS

- \*Clark Co., H. W., Mattoon, Ill.
- \*Doe Co., W. E., Chicago, Ill.
- \*Thompson-Fleming Co., Inc., Buffalo, N. Y.
- \*U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.
- Casey-Hedges Co., Chattanooga, Tenn.
- Clow & Sons, J. B., Chicago, Ill.
- Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
- Madison Fdry. Co., Cleveland, O.
- Pechstein Iron Works, Keokuk, Iowa.
- Sessions Fdry. Co., Bristol, Conn.

### CATCH BASIN CLEANING APPARATUS

- \*Otterson Auto Eductor Co., Springfield, O.

### CAULKING MACHINERY

- \*Mueller Mfg. Co., H. Decatur, Ill.
- \*Smith Mfg. Co., A. P., East Orange, N. J.
- Helwig Mfg. Co., St. Paul, Minn.
- Ingersoll-Rand Co., N. Y. C.

### CAULKING MATERIALS

- \*Leadite Co., Philadelphia, Pa.
- \*United Lead Company, New York.

### CEMENT

- \*Alpha Portland Cement Co., Easton, Pa.
- \*Penns. Cement Co., New York.
- Ash Grove Lime & Portland Cement Co., Kansas City, Mo.
- Atlas Portland Cement Co., New York.
- Canada Cement Co., Ltd., Montreal, Can.
- Clinchfield Port. Cem. Corp., Kingsport, Tenn.
- Crescent Portland Cement Co., Wampum, Pa.
- Dewey Portland Cement Co., Kansas City, Mo.
- Dixie Portland Cement Co., Chattanooga, Tenn.
- Lehigh Portland Cement Co., Allentown, Pa.
- Marquette Cement Mfg. Co., Chicago, Ill.
- Riverside Portland Cement Co., Los Angeles, Cal.
- Sandusky Cement Co., Cleveland, Ohio.
- Texas Portland Cement Co., Dallas, Tex.
- Universal Portland Cement Co., Chicago, Ill.
- Wabash Portland Cement Co., Detroit, Mich.

### CEMENT INSPECTION (See Inspecting Laboratories)

### CEMENT MAKING MACHINERY

- \*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- \*Austin Machinery Corp'n, Chicago, Ill.
- Fuller-Lehigh Co., Fullerton, Pa.
- Vulcan Iron Works, Wilkesbarre, Pa.



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\*Niagara Metal Stamp. Corp., Niagara Falls, N. Y.  
American Chain Co., Inc., Bridgeport, Conn.  
Columbus McKinnon Chain Co., Columbus, O.  
U. S. Chain & Forge Co., Pittsburgh, Pa.

### CHAINS, STEEL AND MALLEABLE

Chain Belt Co., Milwaukee, Wis.  
Jeffrey Mfg. Co., Columbus, O.  
Link-Belt Co., Chicago, Ill.  
Webster Mfg. Co., Chicago, Ill.

### CHECK VALVES

\*Columbian Iron Works, Chattanooga, Tenn.  
\*Ladlow Valve Mfg. Co., Troy, N. Y.  
\*Mueller Mfg. Co., H. Decatur, Ill.  
Lunkenheimer Co., Cincinnati, O.

### CHEMICALS FOR WATER PURIFICATION

\*Du Pont de Nemours & Co., E. I., Wilmington, Del.  
\*Electro Bleaching Gas Co., New York.  
\*Hoover Electrochemical Co., New York.  
\*Mathieson Alkali Works, Inc., N. Y. C.  
Penn. Salt Mfg. Co., Philadelphia, Pa.  
General Chemical Co., New York.

### CHIMNEYS, CONCRETE

Heinz Chimney Co., Chicago, Ill.  
Rust Engineering Co., Pittsburgh, Pa.  
Weber Chimney Co., Chicago, Ill.

### CHIMNEYS, RADIAL BRICK

Kellogg & Co., M. W., New York.  
Rust Engineering Co., Pittsburgh, Pa.  
Weber Chimney Co., Chicago, Ill.

### CHIMNEYS, STEEL (See Stacks, Steel)

### CHLORINATORS

\*Wallace & Tiernan Co., Inc., New York.

### CHLORINE, LIQUID (See Liquid Chlorine)

### CHUTES, CONCRETE

\*Ransome Concrete Machy. Co., Dunellen, N. J.  
Inslay Mfg. Co., Indianapolis, Ind.  
Lakewood Engineering Co., Cleveland, O.

### CLIPS, WIRE ROPE

\*American Steel & Wire Co., Chicago, Ill.  
American Hoist & Derrick Co., St. Paul, Minn.  
Broderick & Bascom Rope Co., St. Louis, Mo.  
Carpenter Co., Geo. B., Chicago, Ill.  
Leschen & Sons Rope Co., A., St. Louis, Mo.  
Marion Malleable Iron Works, Marion, Ind.  
Roebeling Sons Co., J. A., Trenton, N. J.  
Upson-Walton Co., Cleveland, O.

### COAL AND ORE CONVEYING MACHINERY

\*Good Roads Mach'y Co., Philadelphia, Pa.  
\*Haisz Mfg. Co., Geo., New York.  
Bartlett & Snow Co., O. O., Cleveland, Ohio.  
Blaw-Knox Co., Pittsburgh, Pa.  
Brown Hoisting Machy. Co., Cleveland, O.  
Byers Machine Co., J. F., Cleveland, O.  
Chain Belt Co., Milwaukee, Wis.  
Corrugated Bar Co., Inc., Buffalo, N. Y.  
Gifford-Wood Co., Hudson, N. Y.  
Hayward Co., New York.  
Hunt Co., Inc., C. W., West New Brighton, N. Y.  
Jeffrey Mfg. Co., Columbus, O.  
Lidgerwood Mfg. Co., New York.  
Link-Belt Co., Chicago, Ill.  
Mead-Morrison Mfg. Co., E. Boston, Mass.  
Portable Machinery Co., Passaic, N. J.  
Robins Conveying Belt Co., New York.  
Webster Mfg. Co., Chicago, Ill.

### COCKS, CURB AND CORPORATION

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\*Union Water Meter Co., Worcester, Mass.  
Chapman Valve Mfg. Co., Indian Orchard, Mass.  
Glauber Brass Mfg. Co., Cleveland, O.  
Haydenville Co., Haydenville, Mass.

### COLUMN CLAMPS

Blaw-Knox Co., Pittsburgh, Pa.  
Hydraulic Steelcraft Co., Cleveland, O.  
Inslay Mfg. Co., Indianapolis, Ind.  
Universal Form Clamp Co., Chicago, Ill.

### COMPRESSORS, AIR (See Air Compressors)

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Granitex Corp., New York.  
Horn Co. A. C., Long Island City, N. Y.  
Master Builders Co., Cleveland, O.  
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\*Austin Machinery Corp'n., Chicago, Ill.  
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\*Jaeger Machine Co., Columbus, O.  
\*Koshing Machine Co., Milwaukee, Wis.  
\*Ransome Concrete Machy. Co., Dunellen, N. J.  
\*Standard Scale & Supply Co., Pittsburgh, Pa.  
\*Worthington Pump & Mch'y. Corp., N. Y. C.  
American Cement Machine Co., Keokuk, Ia.  
Atlas Engineering Co., Milwaukee, Wis.  
Badger Concrete Mixer Co., Milwaukee, Wis.  
Chain Belt Co., Milwaukee, Wis.  
Construction Mach'y Co., Waterloo, Iowa.  
Contractors' Equipment Co., Keokuk, Ia.  
Foote Concrete Mch'y. Co., Chicago, Ill.  
Judy Mfg. Co., Centerville, Ia.  
Knickerbocker Co., Jackson, Mich.  
Lakewood Engineering Co., Cleveland, O.  
Lansing Co., Lansing, Mich.  
Oshkosh Mfg. Co., Oshkosh, Wis.  
Schramm & Son, Inc., Chris D., Philadelphia, Pa.  
Smith Co., T. L., Milwaukee, Wis.

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\*American Steel & Wire Co., Chicago, Ill.  
\*National Steel Fabric Co., Pittsburgh, Pa.  
\*Truscon Steel Co., Youngstown, O.  
Carnegie Steel Co., Pittsburgh, Pa.  
Concrete Steel Co., New York.  
Corrugated Bar Co., Inc., Buffalo, N. Y.  
Electric Welding Co., Pittsburgh, Pa.  
General Fireproofing Co., Youngstown, O.  
Inland Steel Co., Chicago, Ill.  
Lackawanna Steel Co., Buffalo, N. Y.  
Ryerson & Son, J. T., Chicago, Ill.  
Wickwire Spencer Steel Corp., Worcester, Mass.

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\*Worthington Pump & Mch'y. Corp., New York.  
Cameron Steam Pump Works, A. S., New York.  
Dear Bros. Steam Pump Wks., Indianapolis, Ind.  
Ingersoll-Rand Co., New York.  
Wheeler Condenser & Eng. Co., Carteret, N. J.

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\*Turbine Sewer Machine Co., Milwaukee, Wis.  
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American Vit. Conduit Co., N. Y. C.  
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\*Craven Co., Frank T., New York.  
\*Forsyth Bros., New York.  
\*King, Philip T., New York, N. Y.  
\*Titan Equipment Co., New York, N. Y.  
\*Zelnicker Supply Co., Walter A., St. Louis, Mo.  
Contractors' Mach. & Supply Co., Pittsburgh, Pa.  
Grey Steel Prod. Co., New York.  
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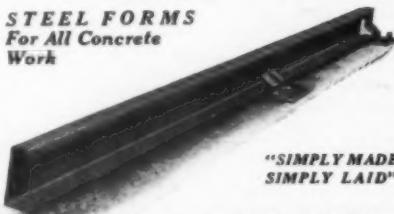
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\*Good Roads Mach'y Co., Philadelphia, Pa.  
\*Haisz Mfg. Co., Geo., New York.  
\*Russell Grader Mfg. Co., Minneapolis, Minn.  
Barber-Green Co., Aurora, Ill.  
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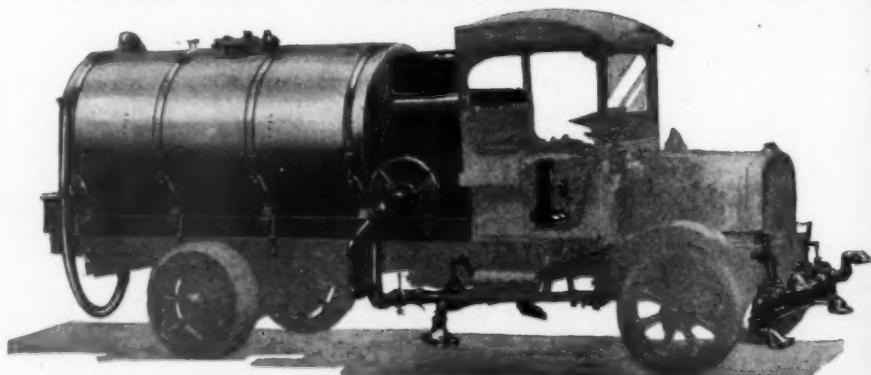
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- Haiss Mfg. Co., Geo., New York.
- \*Russell Grader Mfg. Co., Minneapolis, Minn.
- Atlas Engineering Co., Milwaukee, Wis.
- Barnett & Snow Co., C. O., Cleveland, O.
- Chain Belt Co., Milwaukee, Wis.
- Gifford Wood Co., Hudson, N. Y.
- Godfrey Conveyor Co., Elkhart, Ind.
- Guarantees Constrn. Co., New York.
- Jeffrey Mfg. Co., Columbus, O.
- Link-Belt Co., Chicago, Ill.
- Mead-Morrison Mfg. Co., E. Boston, Mass.
- Republic Rubber Co., Youngstown, O.
- Robins Conv. Bell Co., N. Y. O.
- Webster Mfg. Co., Chicago, Ill.
- Weller Mfg. Co., Chicago, Ill.

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- Pawling & Harnischfeger Co., Milwaukee, Wis.
- Theew Shovel Co., Lorain, O.
- American Hoist & Derrick Co., St. Paul, Minn.
- Brown Hoisting Mch'y. Co., Cleveland, O.
- Browning Co., Cleveland, O.
- Davenport Locomotive Works, Davenport, Ia.
- Hanna Eng. Works, Chicago, Ill.
- Industrial Works, Bay City, Mich.
- Link-Belt Co., Chicago, Ill.
- Locomotive Crane Co. of America, Chicago, Ill.
- McMyler Interstate Co., Cleveland, O.
- Northwest Engineering Works, Chicago, Ill.
- Orton & Steinbrenner Co., Chicago, Ill.
- Ohio Locomotive Crane Co., Bucyrus, O.
- Osgood Co., The, Marion, O.
- Overland Crane Co., Hammond, Ind.
- U. S. Crane Co., Chicago, Ill.

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- \*Pawling & Harnischfeger Co., Milwaukee, Wis.
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- Link-Belt Co., Chicago, Ill.
- Northern Eng. Works, Detroit, Mich.
- Speidel, J. G., Reading, Pa.
- Terry Mfg. Co., Edw. F., N. Y. O.
- Toledo Bridge & Crane Co., Toledo, O.
- U. S. Crane Co., Chicago, Ill.
- Whiting Corp'n, Harvey, Ill.

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- Industrial Works, Bay City, Mich.
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- American Creosote Works, Inc., N. Orleans, La.
- Jennison-Wright Co., Toledo, O.
- Southern Paving Constr. Co., Chattanooga, Tenn.
- Southern Wood Pres. Co., Atlanta, Ga.
- Wyckoff Pipe & Creosoting Co., New York.

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- Southern Creosoting Co., Ltd., Hildell, La.
- Southern Paving Const. Co., Chattanooga, Tenn.
- Wyckoff Pipe & Creosoting Co., New York.

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- \*American Cast Iron Pipe Co., Birmingham, Ala.
- \*Dess Co., W. E., Chicago, Ill.
- \*Good Roads Machinery Co., Philadelphia, Pa.
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- Newport Culvert Co., Newport, Ky.
- Russell Grader Mfg. Co., Minneapolis, Minn.
- \*Truscon Steel Co., Youngstown, O.
- \*U. S. C. I. Pipe & Fdry. Co., Burlington, N. J.
- \*Wood & Co., R. D., Philadelphia, Pa.
- American Rolling Mill Co., Middletown, O.
- Berger Mfg. Co., Canton, O.
- Canton Culvert & Silo Co., Canton, O.
- Edwards Mfg. Co., Cincinnati, O.
- Gallon Iron Works & Mfg. Co., Gallon, O.
- Hardesty Mfg. Co., The R., Denver, Colo.
- Madison Foundry Co., Cleveland, O.
- Southern Metal Culvert Co., Salisbury, N. C.
- Wheeling Corrugating Co., Wheeling, W. Va.

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### CURB BOXES

- \*Casey-Hedges Co., Chattanooga, Tenn.
- \*Clark Co., H. W., Mattoon, Ill.
- \*Mueller Mfg. Co., Decatur, Ill.
- \*Thompson-Fleming Co., Inc., Buffalo, N. Y.
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- Clyde Iron Works, Duluth, Minn.
- Dobie Fdry. & Mach. Co., Niagara Falls, N. Y.
- Federal Bridge & Struc. Co., Waukesha, Wis.
- Flory Mfg. Co., S., Bangor, Pa.
- Insley Mfg. Co., Indianapolis, Ind.
- Lakeside Bridge & Steel Co., N. Milwaukee, Wis.
- Lidgerwood Manufacturing Co., New York.
- Lincoln Iron Works, Rutland, Vt.
- Smith, Whitcomb & Coe Co., Barrie, Vt.
- Superior Iron Works, Superior, Wis.
- Terry Mfg. Co., Edw. F., New York.

### DERRICKS, PIPE LAYING

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- \*Mueller Mfg. Co., H., Decatur, Ill.
- Dobie Fdry. & Mach. Co., Niagara Falls, N. Y.
- Lidgerwood Manufacturing Co., New York.

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- Clyde Iron Works, Duluth, Minn.
- Dobie Fdry. & Mach. Co., Niagara Falls, N. Y.
- Lidgerwood Manufacturing Co., New York.
- Terry Mfg. Co., Edw. F., New York.

### DERRICKS, STEEL

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- American Hoist & Derrick Co., St. Paul, Minn.
- Clyde Iron Works, Duluth, Minn.
- Dobie Fdry. & Mach. Co., Niagara Falls, N. Y.
- Federal Bridge & Struc. Co., Waukesha, Wis.
- Hayward Co., New York.
- Insley Mfg. Co., Indianapolis, Ind.
- Lakeside Bridge & Steel Co., N. Milwaukee, Wis.
- Lidgerwood Manufacturing Co., New York.
- Petroleum Iron Works Co., Sharon, Pa.
- Taylor Portable Steel Derrick Co., Chicago, Ill.
- Terry Mfg. Co., Edw. F., New York.

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- \*Austin Mach. Corp., Chicago, Ill.
- Blaw-Knox Co., Pittsburgh, Pa.
- Clyde Iron Works, Duluth, Minn.
- Dobie Fdry. & Mach. Co., Niagara Falls, N. Y.
- Lidgerwood Manufacturing Co., New York.
- Taylor Portable Steel Derrick Co., Chicago, Ill.

### DERRICKS, TRAVELING

- \*Austin Mach. Corp., Chicago, Ill.
- \*National Hoisting Engine Co., Harrison, N. J.
- American Hoist & Derrick Co., St. Paul, Minn.
- Byers Machine Co., J. F., Ravenna, O.
- Clyde Iron Works, Duluth, Minn.
- Dobie Fdry. & Mach. Co., Niagara Falls, N. Y.
- Hayward Co., New York.
- Hoisting Engine Sales Co., New York.
- Orton & Steinbrenner Co., Chicago, Ill.
- Terry Mfg. Co., Edward F., New York.



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- \*Electro Bleaching Gas Co., New York.
- \*Mathieson Alkali Works, Inc., New York.

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- \*Jaeger Machine Co., Columbus, O.
- \*Koehring Machine Co., Milwaukee, Wis.
- \*Ransome Concrete Machy. Co., Dunellen, N. J.
- Archer Iron Works, Chicago, Ill.
- Insley Mfg. Co., Indianapolis, Ind.
- Lakewood Engineering Co., Cleveland, O.

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- Wilson Corp., J. G., New York.

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- Universal Drafting Machine Co., Cleveland, O.

**DRAWING MATERIALS**

- \*Economy Draw. Table & Mfg. Co., Adrian, Mich.
- \*Kolesch & Co., New York.
- \*Weber & Co., F., Philadelphia, Pa.
- American Blue Print Paper Co., Chicago, Ill.
- American Lead Pencil Co., New York.
- Defiance Mfg. Co., New York.
- Dietzgen Co., E., New York.
- Gurley, W. & L. E., Troy, N. Y.
- Hamilton Mfg. Co., Two Rivers, Wis.
- Kenfult & Eason Co., Hoboken, N. J.
- Lietz Co., A., San Francisco, Cal.
- Spaulding-Moss Co., Boston, Mass.

**DREDGES**

- \*Bucyrus Co., South Milwaukee, Wis.
- \*Marion Steam Shovel Co., Marion, O.
- Bay City Dredge Works, Bay City, Mich.
- Ellcott Machine Corp., Baltimore, Md.
- Hayward Co., New York.
- Lidgerwood Mfg. Co., New York.
- Osgood Co., The, Marion, O.
- Stockton Iron Works, Stockton, Cal.
- Superior Iron Works, Superior, Wis.
- Vulcan Iron Works, Jersey City, N. J.

**DREDGES, DIPPER**

- \*Austin Machinery Corp., Chicago, Ill.
- \*Bucyrus Co., South Milwaukee, Wis.
- \*Marion Steam Shovel Co., Marion, O.
- American Steel Dredge Co., Fort Wayne, Ind.
- Fairbanks Steam Shovel Co., Marion, O.
- Osgood Co., Marion, O.

**DREDGES, HYDRAULIC**

- \*Bucyrus Co., South Milwaukee, Wis.
- \*Marion Steam Shovel Co., Marion, O.
- Ellcott Mach. Corp., Baltimore, Md.
- Fairbanks Steam Shovel Co., Marion, O.
- Morris Machine Works, Baldwinsville, N. Y.

**DRILLS, AIR**

- \*McKiernan-Terry Drill Co., New York.
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- Cleveland Pneumatic Tool Co., Cleveland, O.
- Denver Rock Drill Mfg. Co., Denver, Colo.
- Helwig Mfg. Co., St. Paul, Minn.
- Independent Pneumatic Tool Co., Chicago, Ill.
- Ingersoll-Rand Co., New York.
- Sullivan Machinery Co., Chicago, Ill.

**DRILLS, CORE**

- \*McKiernan-Terry Drill Co., New York.
- Dobbin Core Drill Co., Inc., New York.
- Ingersoll-Rand Co., New York.
- Standard Diamond Drill Co., Chicago, Ill.

**DRILLS, HAMMER**

- \*McKiernan-Terry Drill Co., New York.
- Chicago Pneumatic Tool Co., New York.
- Cleveland Pneumatic Tool Co., Cleveland, O.
- Denver Rock Drill Mfg. Co., Denver, Colo.
- Helwig Mfg. Co., St. Paul, Minn.
- Ingersoll-Rand Co., New York.
- Sullivan Machinery Co., Chicago, Ill.

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- Chicago Pneumatic Tool Co., New York.
- Denver Rock Drill Mfg. Co., Denver, Colo.
- Helwig Mfg. Co., St. Paul, Minn.
- Ingersoll-Rand Co., New York.
- Sullivan Machinery Co., Chicago, Ill.
- Wood Drill Works, Paterson, N. J.

**DRUMS, HOLDING**

- Blaw-Knox Co., Pittsburgh, Pa.
- Clyde Iron Works, Duluth, Minn.
- Dobbin Fdry. & Mach. Co., Niagara Falls, N. Y.
- Monahay Co., New York.
- Monighan Machine Co., Chicago, Ill.

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- \*Allis-Chalmers Co., Milwaukee, Wis.
- American Blower Co., Detroit, Mich.
- American Process Co., New York.
- Atlas Dryer Co., Cleveland, O.
- Bartlett & Snow Co., C. O., Cleveland, O.
- Cummer & Son Co., F. D., Cleveland, O.
- East Iron & Machine Co., Lima, O.
- Ruggies-Coles Eng. Co., New York.
- Variety Iron & Steel Works, Cleveland, O.

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- \*Hell Company, Milwaukee, Wis.
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- \*Littlesford Bros., Cincinnati, O.
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- Auto Truck Steel Body Co., Chicago, Ill.
- Columbian Steel Tank Co., Kansas City, Mo.
- Horizontal Hydraulic Hoist Co., Milwaukee, Wis.
- Pechstein Iron Works, Keokuk, Iowa.
- Simplex Mfg. Co., Conneautville, Pa.
- Van Dorn Iron Works, Cleveland, Ohio.
- Wood Hydraulic Hoist & Body Co., Detroit, Mich.

**DUMP CARTS AND WAGONS**

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- \*Arcadia Trailer Corp., Newark, N. Y.
- \*Austin Western Road Mch. Co., Chicago, Ill.
- \*Lyle Cuy. & Rd. Equip. Co., Minneapolis, Minn.
- \*Russell Grader Mfg. Co., Minneapolis, Minn.
- \*Tiffin Wagon Co., Tiffin, Ohio.
- Acme Wagon Co., Emigville, Pa.
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In the south San Joaquin Irrigation District near Manteca two P & H Excavators dug and cleared the ditches. Merced County used them for unloading crushed rock and gravel from cars for the county highways.

A. E. Conell, county engineer, Livingston, unloaded eight cars of rock and sand in a day, stock piles along the track.

All the levees and filling walls for the flood control project at Long Beach was accomplished by the United Dredging Co. through a P & H "Old Bess" (as this reliable excavating, handling, and power crane is often called), tore up the old concrete roads, graded, made cuts and fills, built approaches to new bridges, working continuously day and night, month after month. It earned its cost many times over on this one job alone.

The Los Angeles County Flood Control District is also using a P & H to complete the canals and laterals to take off the flood waters.

Peter Ferry, constructing a highway at Harbor City, California, used a P & H in a similar manner. First, "Old Bess" graded, built approaches, cut and filled. When surfacing was started, she was run to the siding to unload rock and sand from cars to bunkers. Measured batches were lifted from trucks to paver later.

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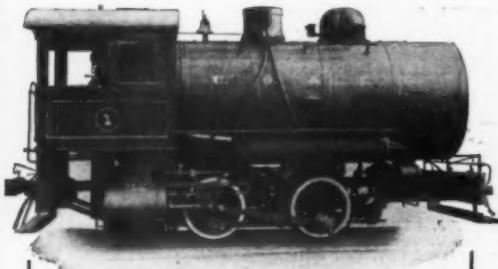
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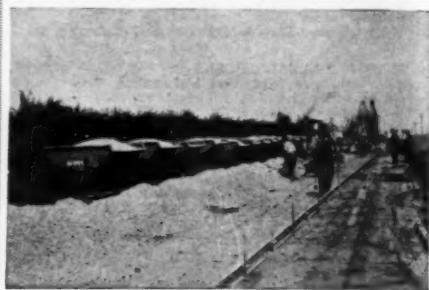
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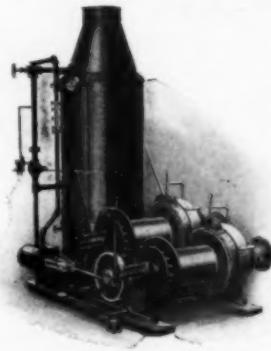
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Clyde Iron Works, Duluth, Minn.  
Denver Rock Drill Mfg. Co., Denver, Colo.  
Flory Mfg. Co., S., Bangor, Pa.  
Hardie-Tynes Mfg. Co., Birmingham, Ala.  
Ingersoll-Rand Co., New York.  
Insley Mfg. Co., Indianapolis, Ind.  
Lidgerwood Mfg. Co., New York.  
Mead-Morrison Mfg. Co., E. Boston, Mass.  
Mundy Hoisting Eng. Co., J. S., Newark, N. J.

**HOISTS, HYDRAULIC FOR MOTOR TRUCKS**

\*Hell Co., The Milwaukee, Wis.  
Horizontal Hydr. Hoist Co., Milwaukee, Wis.  
Wood Hydr. Hoist & Body Co., Detroit, Mich.

**HOISTS, PNEUMATIC**

\*Worthington Pump & Mchy. Corp., New York.  
Chicago Pneumatic Tool Co., New York.  
Denver Rock Drill Mfg. Co., Denver, Colo.  
Detroit Hoist & Machine Co., Detroit, Mich.  
Flory Mfg. Co., Bangor, Pa.  
Hann Eng. Works, Chicago, Ill.  
Independent Pneumatic Tool Co., Chicago, Ill.  
Ingersoll-Rand Co., New York.  
Northern Engineering Works, Detroit, Mich.

**HOLLOW TILE**

\*Doe Co., Wm. E., Chicago, Ill.  
\*Delaware Clay Products Co., Pittsburgh, Pa.  
Bannon Pipe Co., P., Louisville, Ky.  
Dickey Clay Mfg. Co., W. S., Kansas City, Mo.  
Medal Paving Brick Co., Cleveland, Ohio.  
Metropolitan Paving Brick Co., Canton, Ohio.  
National Fireproofing Co., Pittsburgh, Pa.

**HOPPERS, CONCRETE**

\*Koehring Mach. Co., Milwaukee, Wis.  
\*Littleford Bros., Cincinnati, O.  
\*Ransome Concrete Mchy. Co., Dunellen, N. J.  
Honhorst Co., Jos., Cincinnati, Ohio.  
Insley Mfg. Co., Indianapolis, Ind.  
Lakewood Engineering Co., Cleveland, O.

**HOSE, AIR**

Cincinnati Rubber Mfg. Co., Cincinnati, O.  
Goodyear Tire & Rubber Co., Akron, O.  
Ingersoll-Rand Co., New York.  
Penna Flexible Metallic Tubing Co., Phila., Pa.  
Republic Rubber Co., Youngstown, O.  
U. S. Rubber Co., New York

**HOUSES, PORTABLE. (See Buildings, Portable)**

**HYDRANTS, FIRE**

\*Columbian Iron Works, Chattanooga, Tenn.  
\*Eddy Valve Mfg. Co., Waterford, N. Y.  
\*Kennedy Valve Mfg. Co., Elmira, N. Y.  
\*Lindlow Valve Mfg. Co., Troy, N. Y.  
\*Norwood Engineering Co., Florence, Mass.  
\*Rensselaer Valve Co., Troy, N. Y.  
\*Smith Mfg. Co., A. P., East Orange, N. J.  
\*Wood & Co., R. D., Philadelphia, Pa.  
Chapman Valve Mfg. Co., Indian Orchard, Mass.  
Darling Valve Mfg. Co., Williamsport, Pa.  
Iowa Valve Co., Oaklaloosa, Ia.

**INCINERATORS, GARBAGE. (See Garbage Disposal)**

**INDICATOR POSTS. (See Valves)**

**INSPECTING LABORATORIES**

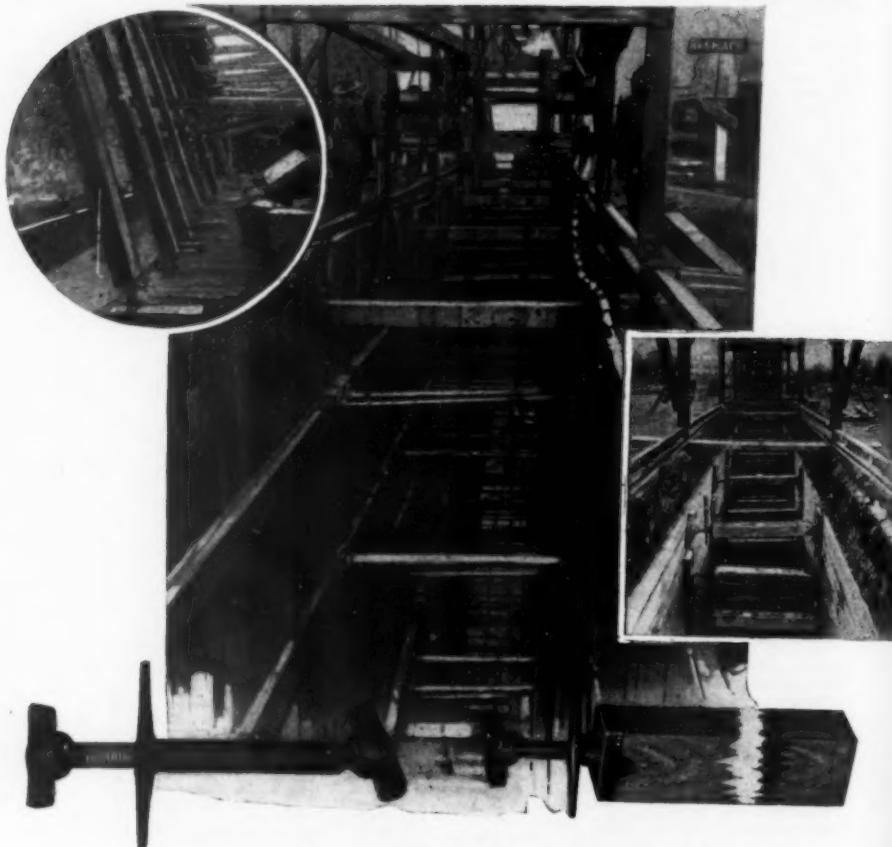
Allentown Testing Laboratories, Allentown, Pa.  
Conard & Busby, Burlington, N. J.  
Hunt & Co., Robert W., Chicago, Ill.  
Pittsburgh Testing Laboratories, Pittsburgh, Pa.

**INSTRUMENTS AND SUPPLIES. (Surveyors' and Engineers')**

\*Koelsch & Co., New York.  
Ainsworth & Sons, Wm., Denver, Col.  
Alo Co., A. S., St. Louis, Mo.  
Berger & Sons, C. L., Boston, Mass.  
Brands & Sons Mfg. Co., Brooklyn, N. Y.  
Buff & Buff Mfg. Co., Boston, Mass.  
Dietzgen Co., Eugene, Chicago, Ill.  
Gurley, W. & L. E., Troy, N. Y.  
Keuffel & Esser Co., Hoboken, N. J.  
Lietz Co., A., San Francisco, Cal.

\*Indicates that the manufacturer carries an advertisement. See index facing inside back cover.

# DUFF TRENCH AND EXCAVATION BRACES



## Examples of Efficient Bracing

**A** GLANCE at these actual examples will show you how practical and convenient Duff Trench Braces really are. Fit any width trench. Iron Brace is adapted for all ordinary sized work, Screw-and-Timber Brace for vertical bracing and extra wide excavations.

Save time and money. Easy to install. A twist of the handle and they bite into the sheet-

ing. No sliding or unevenness can loosen their grip. They can be removed as easily and used repeatedly on different jobs. Readily adapted to any width trench.

The labor and time you will save by the use of Duff Braces will amount on one good-sized contract to more than their cost. Write us for prices.

**THE DUFF MANUFACTURING COMPANY, PITTSBURGH**

## Where to Purchase

21

Leopold & Voelbel, Portland, Ore.  
 Pfister, Wm. H., Cincinnati, O.  
 Ulmer, J. C., Co., Cleveland, Ohio.  
 Weber & Co., Philadelphia, Pa.  
 White Co., David, Milwaukee, Wis.  
 Wissler Instrument Co., St. Louis, Mo.

### IRON WORK, STRUCTURAL AND ORNAMENTAL (See Bridges and Buildings)

JACKS, LIFTING  
 \*Duff Mfg. Co., Pittsburgh, Pa.  
 \*McKellen-Terry Drill Co., New York.  
 Buda Company, Chicago, Ill.  
 Iron City Prod. Co., Pittsburgh, Pa.  
 Joyce-Cridland Co., Dayton, O.  
 Kalamazoo Railway Supply Co., Kalamazoo, Mich.  
 Norton, Inc., A. U., Boston, Mass.  
 Watson-Stillman Company, New York.

JACKS, PIPE FORGING  
 \*Clark Co., H. W., Mattoon, Ill.  
 \*Duff Mfg. Co., Pittsburgh, Pa.

JOINTS, EXPANSION PAVING  
 \*Carey Company, Philip, Cincinnati, O.  
 \*Pioneer Asphalt Co., Lawrenceville, Ill.  
 \*Waring-Underwood Co., Philadelphia, Pa.

### JOINTS, FLEXIBLE PIPE. (See Flexible Joints.)

KETTLES, FOR ASPHALT AND TAR HEATING  
 \*Acme Boad Mach. Co., Frankfort, N. Y.  
 \*Barber Asphalt Paving Co., Philadelphia, Pa.  
 \*Connery & Co., Inc., Philadelphia, Pa.  
 \*Good Roads Machinery Co., Kennett Square, Pa.  
 \*Littleford Bros., Cincinnati, O.  
 \*Tarrant Mfg. Co., Saratoga Springs, N. Y.  
 Honhorst Co., Jos., Cincinnati, Ohio.  
 Macleod Co., Cincinnati, O.  
 Stuhner Iron Wks., G. L., Long Island City, N. Y.

LATH, METAL  
 \*Truscon Steel Co., Youngstown, O.  
 Berger Mfg. Co., Canton, O.  
 Bowtwick Steel Lath Co., Niles, O.  
 Consol. Expanded Metal Co., Braddock, Pa.  
 Corrugated Bar Co., Inc., Buffalo, N. Y.  
 General Fireproofing Co., Youngstown, O.  
 Milwaukee Corrugating Co., Milwaukee, Wis.  
 Northwestern Expanded Metal Co., Chicago, Ill.  
 Penn Metal Co., Boston, Mass.  
 Sykes Metal Lath & Roofing Co., Niles, O.  
 Wickwire Spencer Steel Corp., Worcester, Mass.  
 Youngstown Pressed Steel Co., Warren, O.

LEADITE  
 \*Leadite Co., The, Philadelphia, Pa.

LEAK FINDERS  
 \*Clark & Co., H. W., Mattoon, Ill.  
 \*Pitometer Company, New York.

LETTERS AND FIGURES, METAL  
 \*Niagara Metal Stamp Corp., Niagara Falls, N. Y.

LIGHTS, CONTRACTORS  
 \*General Elec. Co., Schenectady, N. Y.  
 Carbic Mfg. Co., Duluth, Minn.  
 Macleod Co., Alex., Baltimore, Md.  
 Prest-O-Lite Co., Inc., New York.

LIGHTING STANDARDS  
 \*Electric Railway Equip. Co., Cincinnati, O.  
 \*King Mfg. Co., Chicago, Ill.  
 \*Stewart Iron Works Co., Cincinnati, O.  
 \*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.  
 Claw & Sons, J. B., Chicago, Ill.  
 Union Metal Mfg. Co., Canton, O.

LIQUID CHLORINE  
 \*Electro Bleaching Gas Co., New York.  
 \*Hoover Electrochemical Co., New York.  
 \*Mathieson Alkali Works, Inc., New York.  
 \*Penn. Salt Mfg. Co., Philadelphia, Pa.

### LOADERS, GRAVEL AND WAGON

\*Austin Machinery Corp'n., Chicago, Ill.  
 \*Fairfield Engineering Co., Lancaster, O.  
 \*Haiss Mfg. Co., Gee, New York.  
 \*Lee Trailer & Body Co., Chicago, Ill.  
 \*Lyle Clev. & Ed. Equip. Co., Minneapolis, Minn.  
 Atina Engineering Co., Milwaukee, Wis.  
 Barber-Greene Co., Aurora, Ill.  
 Bay City Dredge Works, Bay City, Mich.  
 Bonney Supply Co., Inc., Rochester, N. Y.  
 Gifford Wood Co., Hudson, N. Y.  
 Jeffrey Mfg. Co., Columbus, O.  
 Link Belt Co., Chicago, Ill.  
 Portable Mch'y. Co., Passaic, N. J.  
 Sackett Screen & Chute Co., H. B., Chicago, Ill.  
 Seaman Bros., Chicago, Ill.  
 Smith Co., T. L., Milwaukee, Wis.

### LOCK BAR STEEL PIPE

\*East Jersey Pipe Co., New York

### LOCKERS, STEEL

\*Medart Mfg. Co., Fred., St. Louis, Mo.  
 Hart & Hutchinson Co., New Britain, Conn.

### LOCOMOTIVES, FOR CONTRACTORS, ETC.

\*Austin Mach. Corp., Chicago, Ill.  
 \*Koppel Industrial Car & Equip. Co., Koppel, Pa.  
 \*Foster Co., H. K., Pittsburgh, Pa.  
 \*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.  
 American Locomotive Co., New York, N. Y.  
 Baldwin Locomotive Works, Philadelphia, Pa.  
 Burton Eng. & Mach. Co., Cincinnati, O.  
 Cummings Mach. Co., Minster, O.  
 Crapster, Herbert, New York.  
 Davenport Locomotive Works, Davenport, Ia.  
 Fate-Roof-Heath Co., Plymouth, O.  
 Hadfield-Penfeld Steel Co., Bucyrus, O.  
 Lima Locomotive Wks., Lima, O.  
 Milwaukee Locomotive Mfg. Co., Milwaukee, Wis.  
 Vulcan Iron Works, Wilkes-Barre, Pa.  
 Whitecomb Co., Geo. D., Rochelle, Ill.

### LUMBER, HEAVY CONSTRUCTION

Brown Co., Portland, Me.  
 Crowell & Spence Lumber Co., Long Leaf, La.  
 Great Southern Lumber Co., Bogalusa, La.  
 Industrial Lumber Co., Elizabeth, La.  
 Long Bell Lumber Co., Kansas City, Mo.  
 Sargent Lumber Co., Little Rock, Ark.  
 Stern Co., Inc., E. J., New York.  
 Weyerhaeuser Sales Co., Spokane, Wash.

### LUMBER, STEEL

\*Truscon Steel Co., Detroit, Mich.  
 Berger Mfg. Co., Canton, O.  
 General Fireproofing Co., Youngstown, O.  
 National Pressed Steel Co., Massillon, O.  
 Northwestern Exp. Metal Co., Chicago, Ill.

### MANHOLE COVERS (See Catch Basins)

METAL LATH. (See "Lath")

### METAL ROOFING (See "Roofing")

### METER BOXES

\*Clark Co., H. W., Mattoon, Ill.  
 \*Columbian Iron Works, Chattanooga, Tenn.  
 \*Ford Meter Box Co., Wabash, Ind.  
 \*Mueller Mfg. Co., H., Decatur, Ill.  
 \*Pittsburgh Meter Co., E. Pittsburgh, Pa.  
 Claw & Sons, J. B., Chicago, Ill.  
 McNutt Meter Box Co., Brasil, Ind.  
 S. E. T. Valve & Hydrant Co., New York.

### METER COUPLINGS

\*Clark Co., H. W., Mattoon, Ill.  
 \*Ford Meter Box Co., Wabash, Ind.  
 \*Mueller Mfg. Co., H., Decatur, Ill.  
 \*Neptune Meter Co., New York.  
 \*Pittsburgh Meter Co., E. Pittsburgh, Pa.  
 \*Union Water Meter Co., Worcester, Mass.  
 McNutt Meter Box Co., Brasil, Ind.

### METER TESTERS

\*Buffalo Meter Co., Buffalo, N. Y.  
 \*Clark Co., H. W., Mattoon, Ill.  
 \*Ford Meter Box Co., Wabash, Ind.  
 \*Mueller Mfg. Co., H., Decatur, Ill.  
 \*National Meter Co., New York.  
 \*Neptune Meter Co., New York.  
 \*Pittsburgh Meter Co., E. Pittsburgh, Pa.

\*Indicates that the manufacturer carries an advertisement. See index facing inside back cover.

# Buffalo-Pitts and Kelly-Springfield Rollers—Steam and Motor

All Types and Sizes



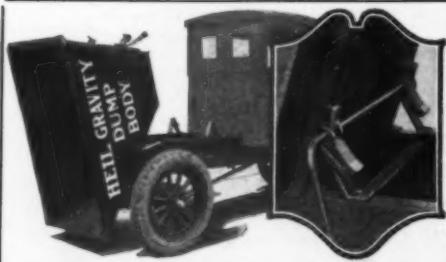
With or without Scarifier attachment.

Helps you finish the job on time.

No breakdowns—no trouble.

*Send for catalog A for complete information.*

**THE BUFFALO-SPRINGFIELD ROLLER CO.  
SPRINGFIELD**      **OHIO**



**\$100.00 BUYS THIS ONE YARD GRAVITY DUMP BODY**

Heil's patented Gravity Body, especially adapted for use in building concrete roads, is economical, efficient and simple.

The Body is electrically welded throughout making it absolutely water tight. Self locking hooks hold it firmly in place. It tips and rolls over on pivots giving a big dumping angle. Four "U" bolts fasten it to the chassis. Tell us the make, model and wheelbase and body capacity desired. We can supply your wants.

*Literature and prices on request.*

**THE HEIL CO.**  
1243 26th AVENUE      MILWAUKEE, WIS.  
Branches in all principal cities      HOISTS      TANKS  
DUMP BODIES

**BAKER**

**MANEY**  
Self-Loading  
SCRAPERS

They dig, load, haul, dump and spread

Write to

THE BAKER MFG. CO.  
503 Stanford Ave., Springfield, Ill.



**RAILROAD and STRUCTURAL HARDWOOD**

**Oak Oil Rig Stock      Bridge Plank**

**All items of Oak Yard Stock**

**FOR PROMPT SHIPMENT**

**SARGENT LUMBER CO.**  
LITTLE ROCK, ARK.

## Where to Purchase

23

### METERS, WATER

- \*Badger Meter Mfg. Co., Milwaukee, Wis.
- \*Builders Iron Fdry., Providence, R. I.
- \*Buffalo Meter Co., Buffalo, New York.
- \*Gamon Meter Co., Newark, N. J.
- \*Hersey Mfg. Co., Boston, Mass.
- \*National Meter Co., New York.
- \*Neptune Meter Co., New York.
- \*Pittsburgh Meter Co., E. Pittsburgh, Pa.
- \*Simplex Valve & Meter Co., Philadelphia, Pa.
- \*Thomson Meter Co., Brooklyn, N. Y.
- \*Union Water Meter Co., Worcester, Mass.
- \*Worthington Pump & Mch'y. Corp., New York.

### MIXERS, CONCRETE. (See Concrete Mixers.)

### MIXERS, GROUT

- American Cement Mch'y. Co., Keokuk, Ia.
- Kent Machine Co., Kent, O.
- Lakewood Engineering Co., Cleveland, O.
- Univ. Iron Works, Inc., Hoboken, N. J.

### MIXERS, HOT

- \*Austin Machinery Corp'n., Chicago, Ill.
- \*Barber Asphalt Paving Co., Philadelphia, Pa.
- \*Koehring Machine Co., Milwaukee, Wis.
- Kent Machine Co., Kent, O.

### MIXERS, MORTAR

- \*Austin Machinery Corp'n., Chicago, Ill.
- \*Bansome Concrete Machy. Co., Dunellen, N. J.
- \*Standard Scale & Supply Co., Pittsburgh, Pa.
- American Cement Machine Co., Keokuk, Ia.
- Blaw-Knox Co., Pittsburgh, Pa.
- C. H. & E. Mfg. Co., Milwaukee, Wis.
- Construction Machinery Co., Waterloo, Ia.
- Kent Machine Co., Kent, O.
- Knickerbocker Co., Jackson, Mich.
- Lansing Co., Lansing, Mich.
- Lakewood Engineering Co., Cleveland, Ohio.
- Smith Co., T. L., Milwaukee, Wis.

### MOTORS, ELECTRIC

- \*Allis Chalmers Mfg. Co., Milwaukee, Wis.
- \*Fairbanks, Morse & Co., Chicago, Ill.
- \*General Electric Co., Schenectady, N. Y.
- \*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
- Crocker-Wheeler Co., Ampere, N. J.
- Lincoln Electric Co., Cleveland, Ohio.
- Robbins & Myers Co., Springfield, O.
- Triumph Electric Co., Cincinnati, O.
- Wagner Elec. Mfg. Co., St. Louis, Mo.

### MOTOR FIRE APPARATUS

- Ahrens-Fox Fire Engine Co., Cincinnati, O.
- American-La France Fire Eng. Co., Elmira, N. Y.
- Childs Co., O. J. Utica, N. Y.
- Prospect Mfg. Co., Prospect, O.
- Seagrave Co., Columbus, O.
- Stutz Fire Engine Co., Indianapolis, Ind.

### MOTOR TRUCKS

- \*Federal Motor Truck Co., Detroit, Mich.
- \*General Motors Truck Co., Pontiac, Mich.
- \*International Motor Co., New York.
- \*Packard Motor Car Co., Detroit, Mich.
- \*Tiffin Wagon Co., Tiffin, O.
- \*White Co., Cleveland, Ohio.
- \*Winton Motor Truck Co., Kenosha, Wis.
- Acason Motor Truck Co., Detroit, Mich.
- Acme Motor Truck Co., Cadillac, Mich.
- All American Truck Co., Chicago, Ill.
- Atterbury Motor Car Co., Buffalo, N. Y.
- Antocar Co., Ardmore, Pa.
- Bessemer Motor Truck Co., Grove City, Pa.
- Bruckway Motor Truck Co., Cortland, N. Y.
- Clydesdale Motor Truck Co., Clyde, O.
- Corbitt Motor Truck Co., Henderson, No. Car.
- Denby Motor Truck Co., Detroit, Mich.
- Diamond T. Motor Car Co., Chicago, Ill.
- Duplex Truck Co., Lansing, Mich.
- Four Wheel Drive Auto Co., Clintonville, Wis.
- Garford Motor Truck Co., Lima, O.
- Gary Motor Truck Co., Gary, Ind.
- Gramm-Bornstein Motor Truck Co., Lima, O.
- Indiana Truck Corp'n., Marion, Ind.
- Jackson Motors Corp'n., Jackson, Mich.
- Kelly Springfield Motor Truck Co., Springfield, O.
- Kiesel Motor Car Co., Hartford, Wis.
- Larrabee-Days Motor Truck Co., Binghamton, N. Y.
- Nash Motors Co., Kenosha, Wis.
- Nelson Motor Truck Co., Saginaw, Mich.
- Pierce Arrow Motor Car Co., Buffalo, N. Y.
- Republie Motor Truck Co., Alma, Mich.
- Selden Truck Corp'n., Co., Wabash, Ind.
- Service Motor Truck Co., Wabash, Ind.

\*Indicates that the manufacturer carries an advertisement. See index facing inside back cover.

- Sterling Motor Truck Co., Milwaukee, Wis.
- Stewart Motor Corp'n., Buffalo, N. Y.
- Titan Motor Truck Co., Milwaukee, Wis.
- Traffic Motor Truck Co., St. Louis, Mo.
- Transport Truck Co., Mt. Pleasant, Mich.
- U. S. Motor Truck Co., Cincinnati, O.
- Veloc Motors Corp., Moline, Ill.
- Ward LaFrance Truck Co., Elmira, N. Y.
- Watson Products Corp'n., Canastota, N. Y.
- Wilson Co., J. C., Detroit, Mich.

### MOULDINGS, CONCRETE

- Blaw-Knox Co., Pittsburgh, Pa.
- Hydraulic Steelcraft Co., Cleveland, O.

### OAKUM

- Wall Rope Works, Beverly, N. J.

### OIL, ROAD

- \*Barber Asphalt Paving Co., Philadelphia, Pa.
- \*Barrett Co., New York.
- \*Pioneer Asphalt Co., Lawrenceville, Ill.
- \*Standard Oil Co. of Indiana, Chicago, Ill.
- \*Texas Company, New York.
- Atlantic Refining Co., Philadelphia, Pa.
- Headley Good Roads Co., Philadelphia, Pa.
- Pierce Oil Corp., New York.
- Sinclair Refining Co., Chicago, Ill.
- Standard Oil Co., (La.) New Orleans, La.
- Standard Oil Co., (N. J.) Newark, N. J.
- U. S. Asphalt Refining Co., New York.

### OIL TANKS

- \*Chicago Bridge & Iron Works, Chicago, Ill.
- \*Connelly & Co., Inc., Philadelphia, Pa.
- \*Hell Co., Milwaukee, Wis.
- \*Pacific Tank & Pipe Co., San Francisco, Cal.
- \*Littleford Bros., Cincinnati, O.
- \*Pittsburgh Des Moines Steel Co., Pittsburgh, Pa.
- \*United Iron Works, Inc., Kansas City, Mo.
- Biggs Boiler Works Co., Akron, O.
- Bower & Co., S. F., Fort Wayne, Ind.
- Chatta. Boiler & Tank Co., Chattanooga, Tenn.
- Chicago Bridge & Iron Works, Chicago, Ill.
- Dover Boiler Works, Dover, N. J.
- Fouts Co. U. C., Middletown, O.
- Honhorst Co., Jos., Cincinnati, Ohio.
- Petroleum Iron Works Co., Sharon, Pa.
- Ritter-Conley Co., Pittsburgh, Pa.
- Scaife & Sons Co., Wm. B., Pittsburgh, Pa.
- Scaife & Weldner Boiler Co., Chattanooga, Tenn.
- Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

### PACKING, WATER PIPE

- \*Leadite Co., The, Philadelphia, Pa.
- \*Union Water Meter Co., Worcester, Mass.
- \*United Lead Company, New York.

### PAINTS, METAL PROTECTION

- \*Barber Asphalt Paving Co., Philadelphia, Pa.
- \*Barrett Co., New York.
- \*Dixie Crucible Co., Jos., Jersey City, N. J.
- \*Du Pont de Nemours & Co., Inc., E. I., Wilmington, Del.

- Berry Bros., Detroit, Mich.

- Cook Paint Co., Kansas City, Mo.

- Detroit Graphite Co., Detroit, Mich.

- Longman & Martines, New York.

- Minwax Co., New York.

- Protexol Corp., New York.

- Ruberoid Co., New York.

- Semet-Solvay Co., Syracuse, N. Y.

- Sherwin-Williams Co., Cleveland, O.

- Sonneborn Sons, Inc., L., New York.

- Toch Bros., New York.

### PAPERS, BLUE PRINT AND BROWN PRINT

- Indianapolis Blue Print & Supply Co., Indianapolis, Ind.

### PAPER, BUILDING, ROOFING, ETC.

- \*Barber Asphalt Paving Co., Philadelphia, Pa.
- \*Barrett Co., New York.
- \*Carey Co., Phillip, Cincinnati, O.
- Bird & Son, E. Walpole, Mass.
- Brown Co., Portland, Me.
- Hydrex Felt & Eng. Co., New York.
- Johns-Manville, Inc., New York.
- National Roofing Co., Tonawanda, N. Y.
- Ruberoid Co., New York.

### PAVING AND ROAD ROLLERS (See Road and Paving Rollers)

### PAVING BLOCKS, CREEOSOTED WOOD

- \*Republic Creosoting Co., Youngstown, O.
- American Creosote Wks., Inc., New Orleans, La.
- Jennison-Wright Co., Toledo, O.
- Protexol Corp., New York.

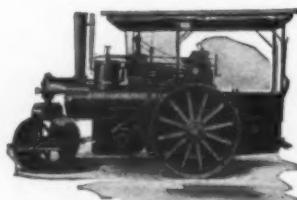
# ONE OF OUR SALESMEN SAID

I like to sell our line of Road Building and Contractors' Machinery because it is complete, and I can always offer the customer just what he wants.



The Little Winner Road Grader.  
Weight 1600 pounds. Blade  
6 ft. long.

Our line *is* complete. We furnish portable and stationary Rock Crushing Plants in many different sizes. Tandem and Macadam Steam Road Rollers. Six different sizes of Road Graders. Several types of Road Drags. Oiling Machinery, Heating Kettles, Dump Wagons, Sprinklers, Sweepers and Culvert Pipe.



Monarch Steam Road Roller.  
Made in 10 and 12 ton sizes.

But,— There is something more than a complete line that accounts for the popularity of our goods. We build high class goods. Sell them at reasonable prices, and we give service with every article that goes out of our plants.

Ask for  
catalogue.

Everything for  
the Road Maker.

It will interest  
you.



Champion Crusher, Mounted  
with Elevator, Screen, and  
Portable Stone Bin. Made in  
many sizes from 50 to 300 tons  
daily capacities.

**The Good Roads Machinery Company, Inc.**  
821 Bulletin Building, Philadelphia, Pa.

BRANCH OFFICES IN ALL PRINCIPAL CITIES.

**PAVING BRICK**

- \*Metropolitan Paving Brick Co., Canton, O.
- Alton Brick Co., Alton, Ill.
- Barr Clay Co., Streator, Ill.
- Burton Townsend Co., Zanesville, O.
- Flint Brick Co., Des Moines, Ia.
- Hydraulic Press Brick Co., St. Louis, Mo.
- McAvoy Vit. Brick Co., Philadelphia, Pa.
- Mack Mfg. Co., Wheeling, W. Va.
- Mayer Brick Co., C. P., Bridgeville, Pa.
- Medal Paving Brick Co., Cleveland, O.
- Murphysboro Paving Brick Co., Murphysboro, Ill.
- Patton Clay Mfg. Co., Patton, Pa.
- Peebles Brick Co., Portsmouth, O.
- Penn Clay Co., Pittsburgh, Pa.
- Pittsburgh Paving Brick Co., Pittsburgh, Kas.
- Poston Paving Brick Co., Crawfordsville, Ind.
- Purington Paving Brick Co., Galesburg, Ill.
- Southern Clay Mfg. Co., Chattanooga, Tenn.
- Sterling Brick Co., Olean, N. Y.
- Thurber Brick Co., Thurber, Texas.
- Veederburg Paver Co., Veederburg, Ind.

**PAVING MACHINERY**

- \*Austin Mach. Corp., Chicago, Ill.
- \*Austin-Western Road Mch'y. Co., Chicago, Ill.
- \*Barber Asphalt Paving Co., Philadelphia, Pa.
- \*Buffalo-Springfield Boiler Co., Springfield, O.
- \*Equitable Asphalt Mfg. Co., Kansas City, Mo.
- \*Erie Machine Shops, Erie, Pa.
- \*Koshing Machine Co., Milwaukee, Wis.
- Atlas Engineering Co., Milwaukee, Wis.
- Badger Concrete Mixer Co., Milwaukee, Wis.
- Construction Machinery Co., Waterloo, Ia.
- Cummer & Son Co., F. D., Cleveland, O.
- East Iron & Machine Co., Lima, O.
- Judy Mfg. Co., Centerville, Ia.
- Lakewood Engineering Co., Cleveland, O.

**PAVING MATERIALS** (See "Asphalt," "Paving Brick," "Granite Block," etc.)

**PAVING MIXERS.** (See Concrete Mixers)

**PAVING TOOLS**

- \*Barber Asphalt Paving Co., Philadelphia, Pa.
- \*Connery & Co., Inc., Philadelphia, Pa.
- \*Littleford Bros. Co., Cincinnati, O.
- \*Warren Bros. Co., Boston, Mass.
- Anderson Tool & Sup. Co., W. H., Detroit, Mich.
- Kramer Bros. Pdry. Co., Dayton, O.
- Union Iron Works, Hoboken, N. J.

**PERFORATED METALS**

- \*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- PICKS**
- Hubbard Co., Pittsburgh, Pa.
- Iron City Tool Works, Pittsburgh, Pa.
- Klein-Logan Co., Pittsburgh, Pa.
- Verona Tool Works, Verona, Pa.
- Warren Tool & Forge Co., Warren, O.
- Warwood Tool Co., Wheeling, W. Va.

**PILE DRIVERS**

- \*McKernan-Terry Drill Co., New York.
- Browning Co., Cleveland, O.
- Clyde Iron Works, Duluth, Minn.
- Industrial Works, Bay City, Mich.
- Lidgerwood Manufacturing Co., New York.
- McMyler Interstate Co., Cleveland, O.
- Union Iron Works, Hoboken, N. J.

**PILE HAMMERS, STEAM**

- \*McKernan-Terry Drill Co., New York.
- National Hoisting Eng. Co., Harrison, N. J.
- Clyde Iron Works, Duluth, Minn.
- Union Iron Works, Hoboken, N. J.
- Vulcan Iron Works, Chicago, Ill.

**PILING, INTERLOCKING STEEL**

- Carnegie Steel Co., Pittsburgh, Pa.
- Jones & Laughlin Steel Co., Pittsburgh, Pa.
- Lackawanna Steel Co., Buffalo, N. Y.

**PIPE, CAST IRON**

- \*American Cast Iron Pipe Co., Birmingham, Ala.
- \*Central Foundry Co., New York.
- \*Lynchburg Pdry. Co., Lynchburg, Va.
- \*U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.
- \*Warren Pdry. & Machine Co., New York.
- \*Wood & Co., E. D., Philadelphia, Pa.
- Clow & Sons, J. B., Chicago, Ill.

\*Indicates that the manufacturer carries an advertisement. See index facing inside back cover.

Fox & Co., John, New York.

Glamorgan Pipe & Fdry. Co., Lynchburg, Va.

National Cast Iron Pipe Co., Birmingham, Ala.

**PIPE, CORR. METAL**

- \*Good Roads Mach'y Co., Philadelphia, Pa.
- \*Newport Culvert Co., Newport, Ky.
- Canton Culvert & Silo Co., Canton, O.
- Hardesty Mfg. Co., Denver, Col.

**PIPE, LEAD**

- \*United Lead Company, New York.

**PIPE, REINFORCED CONCRETE**

- Lock Joint Pipe Co., E. Orange, N. J.
- Massey Concrete Products Corp'n, Chicago, Ill.

**PIPE, RIVETED STEEL**

- \*Chicago Bridge & Iron Works, Chicago, Ill.
- \*Connery & Co., Inc., Philadelphia, Pa.
- \*East Jersey Pipe Co., New York.
- \*Littleford Bros., Cincinnati, Ohio.
- \*Pittsburgh Des Moines Steel Co., Pittsburgh, Pa.
- Abendroth & Root Mfg. Co., Newburgh, N. Y.
- American Spiral Pipe Works, Chicago, Ill.
- Blaw-Knox Co., Pittsburgh, Pa.
- Canton Culvert & Silo Co., Canton, O.
- Chatta Boiler & Tank Co., Chattanooga, Tenn.
- Hammond Iron Works, Warren, Pa.
- Hardesty Mfg. Co., R., Denver, Col.
- Lancaster Iron Works, Lancaster, Pa.
- Petroleum Iron Works Co., Sharon, Pa.
- Tippet & Wood, Phillipsburg, N. J.

**PIPE, SPIRAL RIVETED**

- \*Pittsburgh Des Moines Steel Co., Pittsburgh, Pa.
- Abendroth & Root Mfg. Co., Newburgh, N. Y.
- American Spiral Pipe Works, Chicago, Ill.
- Lancaster Iron Works, Lancaster, Pa.

**PIPE, STEEL**

- \*East Jersey Pipe Co., New York.
- National Tube Co., Pittsburgh, Pa.
- Youngstown Sheet & Tube Co., Youngstown, O.

**PIPE, WOOD**

- \*American Wood Pipe Co., Tacoma, Wash.
- \*Continental Pipe Mfg. Co., Seattle, Wash.
- \*Pacific Tank & Pipe Co., San Francisco, Cal.
- \*Redwood Mfrs. Co., San Francisco, Cal.
- Michigan Pipe Co., Bay City, Mich.
- Standard Wood Pipe Co., Williamsport, Pa.
- Wyckoff & Sons Co., A., Elmira, N. Y.

**PIPE, WROUGHT IRON**

- Byers Co., A. M., Pittsburgh, Pa.
- Reading Iron Co., Reading, Pa.

**PIPE, COVERING**

- \*Carey Co., Philip, Cincinnati, O.
- \*Continental Pipe Mfg. Co., Seattle, Wash.
- \*Bedwood Mfrs. Co., San Francisco, Cal.
- Johns-Manville, Inc., New York.
- Koehsley & Mattison Co., Ambler, Pa.
- Michigan Pipe Co., Bay City, Mich.
- Pacific Tank & Pipe Co., San Francisco, Cal.
- Standard Wood Pipe Co., Williamsport, Pa.
- Wyckoff & Sons Co., A., Elmira, N. Y.

**PIPE CUTTERS. (See Cutters, Pipe, Hand.)**

**PIPE FITTINGS**

- \*American C. L. Pipe Co., Birmingham, Ala.
- \*Builders Iron Pdry., Providence, R. I.
- \*Central Foundry Co., New York.
- \*Crane Co., Chicago, Ill.
- \*U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.
- \*Warren Pdry. and Mach. Co., New York.
- \*Wood & Co., E. D., Philadelphia, Pa.
- Clow & Sons, J. B., Chicago, Ill.
- Lankenheimer Co., Cincinnati, O.

**PIPE HANDLING MACHINERY**

- \*Mueller Mfg. Co., H., Decatur, Ill.
- Taylor Portable Steel Derrick Co., Chicago, Ill.

**PIPE JOINT COMPOUND, SEWER**

- \*Carey Co., Philip, Cincinnati, O.
- \*Dixon Crucible Co., J., Jersey City, N. J.
- \*Leadite Company, Inc., Philadelphia, Pa.
- \*Pacific Flush Tank Co., Chicago, Ill.
- \*Waring-Underwood Co., Philadelphia, Pa.
- Ruberoid Co., New York.



For Heating and Applying under Pressure all varieties of Bituminous Materials, Hot or Cold, for Road Construction, Maintenance or Dust Laying.

Heat and volume under instant control of operator. Positive pressure produced by the Kinney Pump.

## PATENT COMBINATION Auto Heater and Distributor

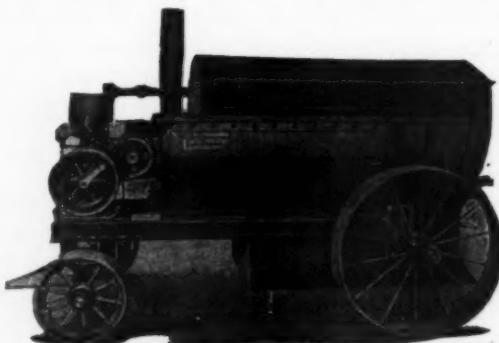


### HANDY HEATER and SPRAYER

Especially adapted for Road maintenance, construction and general repair work. Contents constantly agitated while heating.

No burning or coking of material. Pump, Piping, Hose, Nozzles, Automatically Heated.

No Steam Required.



### Kinney Manufacturing Company

3529 Washington Street  
BOSTON, MASSACHUSETTS

*BRANCHES:*

NEW YORK

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CHICAGO  
SAN FRANCISCO

HOUSTON

KANSAS CITY

## Where to Purchase

27

**PIPE JOINT MATERIAL, CAST IRON**

- \*Leadite Co., The, Philadelphia, Pa.
- \*United Lead Co., New York.
- Lead-Hydro-Tite Co., Boston, Mass.

**PLOWS, CONTRACTORS**

- \*Burch Plow Works Co., Crestline, O.
- \*Holt Mfg. Co., Peoria, Ill.
- \*Marion Steam Shovel Co., Marion, O.
- \*Russell Grader Mfg. Co., Minneapolis, Minn.
- American Steel Scraper Co., Sidney, O.
- Case Threshing Machine Co., J. I., Racine Wis.
- Deere & Co., Moline, Ill.
- Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
- International Harvester Co., Chicago, Ill.
- Moline Plow Co., Moline, Ill.
- Oliver Chilled Plow Works, South Bend, Ind.
- Sidney Steel Scraper Co., Sidney, O.
- Western Wheeled Scraper Co., Aurora, Ill.
- Wiard Plow Co., Batavia, N. Y.

**PLUMBING SUPPLIES**

- \*Mueller Mfg. Co. H., Decatur, Ill.
- \*Bundt Spence Mfg. Co., Milwaukee, Wis.
- Clow & Sons, J. B., Chicago, Ill.
- Glanter Brass Mfg. Co., Cleveland, O.
- United Brass Mfg. Co., Cleveland, O.
- Walworth Mfg. Co., Boston, Mass.

**POLES, STEEL STRUCTURAL**

- \*Electric Railway Equipment Co., Cincinnati, O.
- \*Pittsburgh Des Moines Steel Co., Pittsburgh, Pa.
- Blaw-Knox Co., Pittsburgh, Pa.

**PORTABLE BUILDINGS**

- \*Truscon Steel Co., Youngstown, O.
- Blaw-Knox Co., Pittsburgh, Pa.
- Pruden Co., C. D., Baltimore, Md.

**PORTABLE STEEL DERRICKS. (See Derricks, Steel Portable.)**

**PORTLAND CEMENT. (See Cement.)**

**POWDER. (See Explosives.)**

**PUMPS, AIR LIFT**

- \*Indiana Air Pump Co., Indianapolis, Ind.
- \*Worthington Pump & Mchly. Corp., New York.
- Advance Pump & Compr. Co., Battle Creek, Mich.
- American Steam Pump Co., Battle Creek, Mich.
- Cameron Steam Pump Works, A. S., New York.
- Ingersoll-Rand Co., New York.
- Sullivan Machinery Co., Chicago, Ill.
- Union Steam Pump Co., Battle Creek, Mich.

**PUMPS, BOILER FEED**

- \*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- \*Dayton-Dowd Co., Quincy, Ill.
- \*De Laval Steam Turbine Co., E. Trenton, N. J.
- \*Fairbanks, Morse & Co., Chicago, Ill.
- \*Indiana Air Pump Co., Indianapolis, Ind.
- \*Lea-Courtenay Co., Newark, N. J.
- \*Midwest Engine Co., Indianapolis, Ind.
- \*Yeomans Bros. Co., Chicago, Ill.
- Advance Pump & Compr. Co., Battle Creek, Mich.
- Buffalo Steam Pump Co., Buffalo, N. Y.
- Cameron Steam Pump Works, A. S., New York.
- Dean Bros. Steam Pump Wks., Indianapolis, Ind.
- Deming Co., Salem, O.
- Gardner Governor Co., Quincy, Ill.
- Goulds Mfg. Co., Seneca Falls, N. Y.
- Morris Machine Works, Baldwinsville, N. Y.
- Murray Iron Works Co., Burlington, Ia.
- Scranton Pump Co., Scranton, Pa.
- Vogt Bros. Mfg. Co., Louisville, Ky.
- Warren Steam Pump Co., Warren, Mass.
- Weinman Pump Mfg. Co., Columbus, O.

**PUMPS, CENTRIFUGAL**

- \*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- \*American Well Works, Aurora, Ill.
- Clark Co., H. W., Mattoon, Ill.
- \*Dayton-Dowd Co., Quincy, Ill.
- \*De Laval Steam Turbine Co., Trenton, N. J.
- \*Fairbanks, Morse & Co., Chicago, Ill.
- \*Indiana Air Pump Co., Indianapolis, Ind.
- \*Lea-Courtenay Co., Newark, N. J.
- \*Midwest Engine Co., Indianapolis, Ind.
- \*United Iron Works Co., Kansas City, Mo.
- \*Worthington Pump & Mach. Corp., New York.
- \*Yeomans Bros. Co., Chicago, Ill.

\*Indicates that the manufacturer carries an advertisement. See index facing inside back cover.

- Aurora Pump & Mfg. Co., Aurora, Ill.
- Barnes Mfg. Co., Mansfield, O.
- Camden Iron Works, Camden, N. J.
- Cameron Steam Pump Works, A. S., New York.
- Domestic Eng. & Pump Co., Shippensburg, Pa.
- Erie Pump & Engine Works, Medina, N. Y.
- Goulds Mfg. Co., Seneca Falls, N. Y.
- Keystone Driller Co., Beaver Falls, Pa.
- Maniste Iron Wks., Maniste, Mich.
- Morris Machine Works, Baldwinsville, N. Y.
- Schramm & Son, Inc., Chris. D., Philadelphia, Pa.
- Wheeler Condenser & Eng. Co., Carteret, N. J.

**PUMPS, CONTRACTORS\***

- \*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- \*American Well Works, Aurora, Ill.
- \*Dayton-Dowd Co., Quincy, Ill.
- \*Fairbanks, Morse & Co., Chicago, Ill.
- \*Lee-Courtenay Co., Newark, N. J.
- \*Midwest Engine Co., Indianapolis, Ind.
- \*Standard Scale & Supply Co., Pittsburgh, Pa.
- \*Waldo Bros. & Bond Co., Boston, Mass.
- Barnes Mfg. Co., Mansfield, O.
- C. H. & E. Mfg. Co., Milwaukee, Wis.
- Cameron Steam Pump Works, A. S., New York.
- Construction Mach'y Co., Waterloo, Ia.
- Deming Co., Salem, Ohio.
- Emerson Pump & Valve Co., Alexandria, Va.
- Erie Pump & Engine Works, Medina, N. Y.
- Goulds Mfg. Co., Seneca Falls, N. Y.
- McGowan Co., J. H., Cincinnati, O.
- Morris Machine Works, Baldwinsville, N. Y.
- New York Eng. Co., New York.
- Novo Engine Co., Lansing, Mich.
- Pulsometer Steam Pump Co., New York.
- Schramm & Son, Inc., Chris. D., Philadelphia, Pa.
- Smith Co., T. L., Milwaukee, Wis.
- Universal Motor Co., Oshkosh, Wis.
- Van Nieuwhey Machine Wks., Albany, N. Y.

**PUMPS, DEEP WELL**

- \*American Well Works, Aurora, Ill.
- \*Clark Co., H. W., Mattoon, Ill.
- \*Cook, A. D., Lawrenceburg, Ind.
- \*Fairbanks, Morse & Co., Chicago, Ill.
- \*Indiana Air Pump Co., Indianapolis, Ind.
- \*Midwest Engine Co., Indianapolis, Ind.
- \*Nordberg Mfg. Co., Milwaukee, Wis.
- \*United Iron Works, Kansas City, Mo.
- Aldrich Pump Co., Allentown, Pa.
- Cameron Steam Pump Works, A. S., New York.
- Deming Co., Salem, O.
- Goulds Mfg. Co., Seneca Falls, N. Y.
- Keystone Driller Co., Beaver Falls, Pa.
- Layne & Bowler Co., Memphis, Tenn.
- Weber Subterranean Pump Co., New York.

**PUMPS, DREDGING**

- \*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- \*American Well Works, Aurora, Ill.
- \*Wood & Co., R. D., Philadelphia, Pa.
- \*Worthington Pump & Mchly. Corp., New York.
- Aldrich Pump Co., Allentown, Pa.
- Buffalo Steam Pump Co., Buffalo, N. Y.
- Cameron Steam Pump Wks., A. S., New York.
- Domestic Eng. & Pump Co., Shippensburg, Pa.
- Morris Machine Works, Baldwinsville, N. Y.
- Ramsey Pump Co., Ltd., Seneca Falls, N. Y.

**PUMPS, GASOLINE AND OIL**

- \*Kinney Mfg. Co., Boston, Mass.
- \*Worthington Pump & Mach. Corp., New York.
- Bowser & Co., S. F., Fort Wayne, Ind.

**PUMPS, POWER**

- \*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- \*Dayton-Dowd Co., Quincy, Ill.
- \*De Laval Steam Turbine Co., Trenton, N. J.
- \*Fairbanks, Morse & Co., Chicago, Ill.
- \*Indiana Air Pump Co., Indianapolis, Ind.
- \*Kinney Mfg. Co., Boston, Mass.
- \*Koehring Machine Co., Milwaukee, Wis.
- \*Lea-Courtenay Co., Newark, N. J.
- \*Midwest Engine Co., Indianapolis, Ind.
- \*Nordberg Mfg. Co., Milwaukee, Wis.
- \*Northern Fire Apparatus Co., Minneapolis, Minn.
- \*United Lead Company, New York.
- \*Worthington Pump & Mach. Corp., New York.
- \*Yeomans Bros. Co., Chicago, Ill.
- Alamo Iron Works, San Antonio, Tex.
- American Steam Pump Co., Battle Creek, Mich.
- American Well Works, Aurora, Ill.
- Barnes Mfg. Co., Mansfield, O.
- Cameron Steam Pump Works, A. S., New York.

# MAY IS GRADING TIME

## *Work Your Roads Now*



Austin Rip Snorter  
Grader



Western Aurora  
Grader



Austin Giant  
Grader



Western No. 20  
Grader

Right now is the time to do your grading and resurfacing: now after the heavy April rains.

Roads the country over need working—summer traffic will be heavy.

There is a right way and a wrong way to do each job: one the costly way to grade—the other Economy itself.

The first step is to select the proper machine. It is poor economy to try to make one grader do all of the work of three or four different sizes.

The Austin-Western Road Machinery Company are specialists on grading; have made an extensive study for years of conditions that must be faced and the methods best suited to meet them.

Our line is so complete that we never urge you to pick a grader unsuited to your job. Don't try to change the job to suit your machine. *It costs too much.* You can get a machine exactly suited to your needs.

Come to any of the branches listed below for valuable information and advice on grading problems, or write for complete literature.

## The Austin-Western Road Machinery Co. CHICAGO

Albany  
Atlanta  
Billings  
Boston  
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Columbus  
Dallas  
Denver  
Jackson

Los Angeles  
Nashville  
New Orleans  
Pittsburgh

New York City  
Oklahoma City  
Philadelphia  
Portland

San Francisco  
Salt Lake City  
Topeka  
Wahoo  
St Paul



## Where to Purchase

29

Deming Co., Salem, O.  
 Domestic Eng. & Pump Co., Shippensburg, Pa.  
 Gardner Governor Co., Quincy, Ill.  
 Gilbert & Barker Mfg. Co., Springfield, Mass.  
 Goulds Mfg. Co., Seneca Falls, N. Y.  
 Ingersoll-Rand Co., New York.  
 Lawrence Machine Co., Lawrence, Mass.  
 McGowan Co., J. H., Cincinnati, O.  
 Morris Machine Works, Baldwinsville, N. Y.  
 Weinman Pump Mfg. Co., Columbus, O.

### RAILS AND RAIL JOINTS

\*Zehnicker Supply Co., W. St. Louis, Mo.  
 Bethlehem Steel Co., Bethlehem, Pa.  
 Cambria Steel Co., Philadelphia, Pa.  
 Carnegie Steel Co., Pittsburgh, Pa.  
 Easton Car & Constr. Co., New York.  
 Hirsch Rolling Mill Co., St. Louis, Mo.  
 Lackawanna Steel Co., Buffalo, N. Y.  
 Sweet's Steel Co., Williamsport, Pa.

### RAILROAD DITCHERS

\*Austin Machinery Corp'n., Chicago, Ill.  
 \*Austin-Western Road Mch'y. Co., Chicago, Ill.  
 Marion Steam Shovel Co., Marion, O.  
 \*Trew Shovel Co., Lorain, O.  
 American Hoist & Derrick Co., St. Paul, Minn.  
 Ball Engine Co., Erie, Pa.  
 Buckeye Traction Ditcher Co., Findlay, O.  
 Byers Machine Co., J. F., Ravenna, O.  
 Osgood Co., Marion, O.  
 Parsons Co., Newton, Ia.

### RECORDERS, WATER STAGE

\*Builders Iron Pdry., Providence, R. I.  
 Garley, W. & L. E., Troy, N. Y.

### REINFORCING CONCRETE. (See Concrete Reinforcements.)

### RIVETERS, PNEUMATIC

Alliance Machine Co., Alliance, O.  
 Chicago Pneumatic Tool Co., New York.  
 Cleveland Pneumatic Tool Co., Cleveland, O.  
 Hanna Eng. Works, Chicago, Ill.  
 Helwig Mfg. Co., St. Paul, Minn.  
 Independent Pneumatic Tool Co., Chicago, Ill.  
 Ingersoll-Rand Co., New York.  
 Watson-Stillman Co., New York.

### RIVETS, BRIDGE AND STRUCTURAL. (See Bolts, Nuts, Etc.)

### ROAD OILS. (See Oils, Road.)

### ROAD OILERS

\*Austin-Western Road Mch'y. Co., Chicago, Ill.  
 \*Good Roads Machinery Co., Philadelphia, Pa.  
 \*Kinney Mfg. Co., Boston, Mass.  
 \*Littleford Bros., Cincinnati, Ohio.  
 \*Universal Road Mch'y. Co., Kingston, N. Y.  
 \*White Co., Cleveland, O.  
 Autocar Co., Ardmore, Pa.  
 Etnyre & Co., E. D., Oregon, Ill.  
 Four Wheel Drive Auto Co., Clintonville, Wis.  
 Huber Mfg. Co., Marion, O.  
 Selden Truck Corp'n., Co., Wabash, Ind.  
 Service Motor Truck Co., Wabash, Ind.

### ROAD AND PAVING ROLLERS

\*Austin-Western Road Mch'y. Co., Chicago, Ill.  
 \*Barber Asphalt Paving Co., Philadelphia, Pa.  
 \*Buffalo Springfield Roller Co., Springfield, O.  
 \*Erie Machine Shops, Erie, Pa.  
 \*Good Roads Machinery Co., Philadelphia, Pa.  
 \*Universal Road Mch'y. Co., Kingston, N. Y.  
 Aultman & Taylor Mach. Co., Mansfield, Ohio.  
 Case Threshing Machine Co., J. I., Racine, Wis.

### ROAD AND STREET MACHINERY

\*Acme Road Machinery Co., Frankfort, N. Y.  
 \*Austin Machinery Corp'n., Chicago, Ill.  
 \*Austin-Western Road Mch'y. Co., Chicago, Ill.  
 \*Baker Mfg. Co., Springfield, Ill.  
 \*Barber Asphalt Paving Co., Philadelphia, Pa.  
 \*Buffalo Springfield Roller Co., Springfield, O.  
 \*Connery & Co., Inc., Philadelphia, Pa.  
 \*Erie Machine Shops, Erie, Pa.  
 \*Good Roads Machinery Co., Philadelphia, Pa.  
 \*Hains Mfg. Co., Geo., New York.  
 \*Holt Mfg. Co., Peoria, Ill.  
 \*Kinney Mfg. Co., Boston, Mass.  
 \*Koehring Machine Co., Milwaukee, Wis.  
 \*Koppel Ind. Car & Equipment Co., Koppel, Pa.  
 \*Littleford Bros., Cincinnati, O.  
 \*Lyle Culv. & Ed. Equip. Co., Minneapolis, Minn.  
 \*Russell Grader Mfg. Co., Minneapolis, Minn.

\*Indicates that the manufacturer carries an advertisement. See index facing inside back cover.

\*United Iron Works, Kansas City, Mo.  
 \*Universal Road Mch'y. Co., Kingston, N. Y.  
 Adams & Co., J. D., Indianapolis, Ind.  
 Avery Co., Peoria, Ill.  
 Gallon Iron Wks. & Mfg. Co., Gallon, Ohio.  
 Honhorst Co., Jos., Cincinnati, O.  
 Lakewood Engineering Co., Cleveland, O.  
 Smith & Sons Mfg. Co., Kansas City, Mo.  
 Smith Co., T. L., Milwaukee, Wis.

### ROCK CRUSHERS AND PULVERIZERS

\*Acme Road Machinery Co., Frankfort, N. Y.  
 \*Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
 \*Austin-Western Road Mch'y. Co., Chicago, Ill.  
 \*Good Roads Machinery Co., Philadelphia, Pa.  
 \*Universal Road Machinery Co., Kingston, N. Y.  
 \*Worthington Pump & Mch'y. Corp., New York.  
 Chalmers & Williams, Inc., Chicago Heights, Ill.  
 Fuller Lehigh Co., Fullerton, Pa.  
 Gallon Iron Works Mfg. Co., Gallon, O.  
 Guendler Pat. Crusher & Pulv. Co., St. Louis, Mo.

Jeffrey Mfg. Co., Columbus, O.

Link Belt Co., Philadelphia, Pa.  
 McLanahan-Stone Mch'y. Co., Hollidaysburg, Pa.  
 Raymond Bros. Impact Pulv. Co., Chicago, Ill.  
 Smith Eng. Works, Milwaukee, Wis.  
 Taylor Eng. & Mfg. Co., Allentown, Pa.  
 Thomas Patent Crusher & Pulv. Co., Chicago, Ill.

### ROCK DRILLS. (See Drills, Rock)

### ROOFING, ASPHALT, COMPOSITION, ETC.

\*Barber Asphalt Paving Co., Philadelphia, Pa.  
 \*Barrett Co., New York.  
 \*Carey Mfg. Co., Philip, Cincinnati, O.  
 \*Standard Oil Co. of Indiana, Chicago, Ill.  
 \*Texas Co., New York.  
 American Cement Tile Mfg. Co., Pittsburgh, Pa.  
 Atlantic Refining Co., Philadelphia, Pa.  
 Bird & Son, E. Walpole, Mass.  
 Edwards Mfg. Co., Cincinnati, O.  
 Flintkote Co., Boston, Mass.  
 Johns-Manville Inc., New York.  
 Keystone Roofing Mfg. Co., York, Pa.  
 Lehman Co., The, Chicago, Ill.  
 National Roofing Co., Tonawanda, N. Y.  
 Ruberoid Co., New York.  
 Bell Mountain Co., Chicago, Ill.  
 Sifco Products Co., St. Paul, Minn.  
 Sonnenborn & Sons, Inc., L., New York.  
 Western Elastite Roofing Co., Denver, Colo.

### ROOFING, METAL

\*Trascon Steel Co., Youngstown, O.  
 American Rolling Mill Co., Middletown, Ohio.  
 Berger Mfg. Co., Canton, O.  
 Edwards Mfg. Co., Cincinnati, O.  
 National Metal Roofing Co., Jersey City, N. J.  
 Stark Rolling Mill Co., Canton, O.

### ROOFING KETTLES. (See Kettles)

### ROPE, MANILA

American Mfg. Co., Brooklyn, New York.  
 Columbian Rope Co., Auburn, N. Y.  
 Cupples Cordage Co., Brooklyn, N. Y.  
 Hooven & Allison Co., Xenia, O.  
 Kelly Co., R. A., Xenia, O.  
 New Bedford Cordage Co., New Bedford, Mass.  
 Peoria Cordage Co., Peoria, Ill.  
 Plymouth Cordage Co., N. Plymouth, Mass.  
 Wall Rope Wks., New York.  
 Waterbury Co., New York.  
 Whitlock Cordage Co., New York.

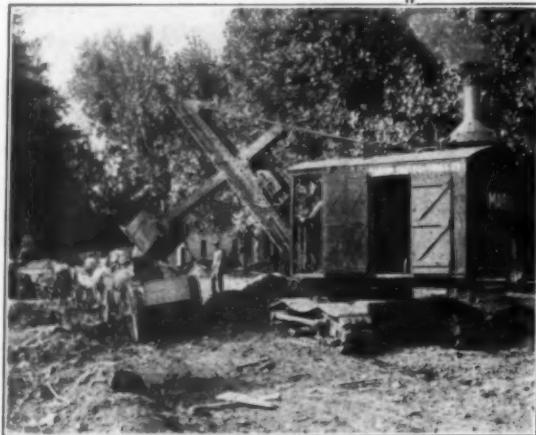
### ROPE, WIRE, HOISTING, HAULAGE

\*American Steel & Wire Co., Chicago, Ill.  
 Broderick & Bascom Rope Co., St. Louis, Mo.  
 Leschen & Sons Rope Co., A., St. Louis, Mo.  
 MacWhyte Co., Kenosha, Wis.  
 Moon Co., Geo. C., Garfield, N. J.  
 Roebling's Sons Co., J. A., Trenton, N. J.  
 Upson-Walton Co., Cleveland, O.  
 Waterbury Co., New York.  
 Wickwire Spencer Steel Corp., Worcester, Mass.  
 Williamsport Wire Rope Co., Williamsport, Pa.

### RULES, FOLDING

\*Kolesch & Co., N. Y. C.  
 Lufkin Rule Co., Saginaw, Mich.

### SASH, ROLLED STEEL. (See Window Frames and Sash)



Contractors want the shovel that will dig the most dirt in the least possible time. The Marion "21" with its inbuilt ruggedness and its ease of handling will keep the wagons or trucks loaded and on the move—demonstrating Marion quality and dependability through service.

The model 21 has a prominent place in our production schedule. It can be furnished with steam, gasoline or electric power.

We will take pleasure in serving you, if you'll give us your requirements.

### The Marion Steam Shovel Co. Marion, Ohio

NEW YORK CHICAGO ATLANTA SAN FRANCISCO



### Speed



Speed in a shovel cannot be measured by the results of a few hours' work under favorable conditions. It is the power to work consistently that counts on the job.

THE THEW SHOVEL CO.  
Lorain, Ohio

***The***  
*Power Shovels*

When writing to advertisers, please mention the Contractors' & Engineers' Monthly

### BUCYRUS STEAM SHOVELS



Are built with the speed, ruggedness and power that assures profit on your job—if you also have crane work, sewer excavation and dragline work to do, you can find a Bucyrus that will fill your bill.

Send for Bulletin C-C (340)

**BUCYRUS COMPANY**  
South Milwaukee, Wisconsin.

## Where to Purchase

31

### SAW RIGS, PORTABLE

- \*Ransome Concrete Mach. Co., Dunnellen, N. J.
- \*Standard Scale & Supply Co., Pittsburgh, Pa.
- C. H. & E. Mfg. Co., Milwaukee Wis.
- Knickerbocker Co., Jackson, Mich.
- Oshkosh Mfg. Co., Oshkosh, Wis.

### SCRAPERS

- \*Acme Road Machy. Co., Frankfort, N. Y.
- \*Austin Western Road Mchy. Co., Chicago, Ill.
- \*Barber Asphalt Paving Co., Philadelphia, Pa.
- \*Buffalo Springfield Roller Co., Springfield, O.
- \*Good Roads Machinery Co., Philadelphia, Pa.
- \*Holt Mfg. Co., Peoria, Ill.
- \*Lyle Cul. & Ed. Equip. Co., Minneapolis, Minn.
- \*Russell Grader Mfg. Co., Minneapolis, Minn.
- \*Universal Road Mchy. Co., Kingston, N. Y.
- Galion Iron Works & Mfg. Co., Galion, O.
- Huber Mfg. Co., Marion, O.

### SCRAPERS, ROAD

- \*Acme Road Machy. Co., Frankfort, N. Y.
- \*Austin-Western Road Mchy. Co., Chicago, Ill.
- \*Baker Mfg. Co., Springfield, O.
- \*Good Roads Machinery Co., Philadelphia, Pa.
- \*Lyle Cul. & Ed. Equip. Co., Minneapolis, Minn.
- \*Russell Grader Co., Minneapolis, Minn.
- Case Threshing Machine Co., J. L. Racine, Wis.
- East Iron & Machine Co., Lima, O.
- Galion Iron Works & Mfg. Co., Galion, O.
- Kilbourne & Jacobs Mfg. Co., Columbus, O.
- Root Spring Scraper Co., Kalamazoo, Mich.
- Sidney Steel Scraper Co., Sidney, O.
- Western Wheeled Scraper Co., Aurora, Ill.

### SCRAPERS, SELF-LOADING

- \*Baker Manufacturing Co., Springfield, Ill.
- Smith & Sons Mfg. Co., Kansas City, Mo.

### SCREENS, SAND, GRAVEL AND COAL

- \*Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- \*Austin-Western Road Mchy. Co., Chicago, Ill.
- \*Good Roads Machy. Co., Philadelphia, Pa.
- \*Haislip Mfg. Co., Geo., New York.
- \*Littleford Bros., Cincinnati, O.
- \*Lyle Cul. & Ed. Equip. Co., Minneapolis, Minn.
- \*Russell Grader Mfg. Co., Minneapolis, Minn.
- Bartlett & Snow Co., Cleveland, O.
- Chain Belt Co., Milwaukee, Wis.
- Gifford-Wood Co., Hudson, N. Y.
- Jeffrey Mfg. Co., Columbus, O.
- Link-Belt Co., Philadelphia, Pa.
- New Jersey Wire Cloth Co., Trenton, N. J.
- Robins Conv. Belt Co., N. Y. C.
- Sackett Screen & Chute Co., H. B., Chicago, Ill.
- Webster Mfg. Co., Chicago, Ill.
- Wickwire Spencer Steel Corp., Worcester, Mass.

### SCREENS, SEWAGE

- \*Pacific Flush Tank Co., Chicago, Ill.
- Chain Belt Co., Milwaukee, Wis.

### SCREWS

- American Screw Co., Providence, R. I.
- Clark Bros. Belt Co., Milldale, Conn.
- St. Louis Screw Co., St. Louis, Mo.

### SECOND-HAND EQUIPMENT

- \*Briggs, Inc., Marvin, Ekn., New York.
- \*Contractors Mach. & Supply Co., Pittsburgh, Pa.
- \*Craven Co., Frank T., New York.
- \*Forayth Bros., New York.
- \*King, Philip T., New York, N. Y.
- \*Titan Equipment Co., New York N. Y.
- \*Zehnicker Supply Co., Walter A., St. Louis, Mo.

### SEWAGE DISPOSAL APPARATUS

- \*Darr Co., The, New York City.
- \*Pacific Flush Tank Co., Chicago, Ill.

### SEWAGE PUMPS AND EJECTORS

- \*Otterson Auto Ejector Co., Springfield, O.
- \*Pacific Flush Tank Co., Chicago, Ill.
- \*Yeoman Bros. Co., Chicago, Ill.
- Erie Pump & Eng. Works, Medina, N. Y.
- Walworth Mfg. Co., Boston, Mass.

### SEWER BLOCKS, SEGMENT

- American Vit. Products Co., Akron, O.
- Denver Sewer Pipe & Clay Co., Denver, Col.
- Dickey Clay Mfg. Co., W. S., Kansas City, Mo.
- Macomb Sewer Pipe Wks., Macomb, Ill.
- McNutt Meter Box Co., Brazil, Ind.
- Red Wing Sewer Pipe Co., Red Wing, Minn.

\*Indicates that the manufacturer carries an advertisement. See index facing inside back cover.

### SEWER CLEANING APPARATUS

- \*Healey, F. J., New York.
- \*Thompson-Fleming Co., Inc., Buffalo, N. Y.
- \*Turbine Sewer Machine Co., Milwaukee, Wis.
- Champion Corporation, Hammond, Ind.

### SEWER PIPE AND DRAIN TILE

- \*Doe Co., Wm. E., Chicago, Ill.
- \*Delaware Clay Products Co., Pittsburgh, Pa.
- American Vit. Products Co., Akron, O.
- Blackmer & Post Pipe Co., St. Louis, Mo.
- Denver Sewer Pipe & Clay Co., Denver, Col.
- National Fireproofing Co., Pittsburgh, Pa.
- Robinson Clay Product Co., Akron, O.

### SEWER RODS

- \*Bissell Co., F., Toledo, O.
- \*Turbine Sewer Machine Co., Milwaukee, Wis.
- Champion Corporation, Hammond, Ind.

### SHOVELS, ELECTRIC

- \*Bucyrus Co., South Milwaukee, Wis.
- \*Marion Steam Shovel Co., Marion, O.
- \*Tew Shovel Co., Lorain, O.

### SHOVELS, GASOLINE

- \*Austin Mach. Corp., Chicago, Ill.
- \*Marion Steam Shovel Co., Marion, O.
- \*Fawling & Harnischfeger Co., Milwaukee, Wis.
- \*Tew Shovel Co., Lorain, O.
- American Steel Dredge Co., Fort Wayne, Ind.
- Fairbanks Steam Shovel Co., Marion, O.

### SHOVELS, HAND

- American Shovel & Stamping Co., Lorain, O.
- Ames Shovel & Tool Co., Boston, Mass.
- Chisholm Shovel Co., Cleveland, O.
- Conenant Shovel Co., Conneaut, O.
- Hubard & Co., Pittsburgh, Pa.
- Indiana Shovel Co., New Castle, Ind.
- Pittsburgh Shovel Co., Pittsburgh, Pa.
- Wood Shovel & Tool Co., Piqua, Ohio.
- Wyoming Shovel Works, Wyoming, Pa.

### SHOVELS, STEAM

- \*Austin Mach. Corp., Chicago, Ill.
- \*Bucyrus Co., South Milwaukee, Wis.
- \*Marion Steam Shovel Co., Marion, O.
- \*Tew Shovel Co., Lorain, O.
- American Steel Dredge Co., Fort Wayne, Ind.
- Ball Engine Co., Erie, Pa.
- Bellwood Steam Shovel Co., Bellwood, Pa.
- Browning Co., Cleveland, O.
- Byers Machine Co., J. F., Ravenna, O.
- Fairbanks Steam Shovel Co., Marion, O.
- Industrial Works, Bay City, Mich.
- Keystone Driller Co., Beaver Falls, Pa.
- Goodwood Co., Marion, O.
- Smith Co., T. L., Milwaukee, Wis.

### SIGNS, STREET AND ROAD

- \*Lyle Cul. & Ed. Equip. Co., Minneapolis, Minn.
- \*Thompson-Fleming Co., Inc., Buffalo, N. Y.
- Baltimore Enamel & Novelty Co., Baltimore, Md.
- Ingram-Richardson Mfg. Co., Beaver Falls, Pa.
- N. Y. Enameled Steel Sign Co., New York.
- Union Iron Products Co., East Chicago, Ind.

### SLEEVES, TAPPING AND VALVE

- \*Mueller Mfg. Co., Decatur, Ill.
- \*Ranssaeval Valve Co., Troy, N. Y.
- \*Smith Mfg. Co., A. P., East Orange, N. J.

### SLUICE GATES. (See Gates, Sluice.)

### SNOW CLEARING MACHINERY

- \*Austin-Western Road Mchy. Co., Chicago, Ill.
- \*Baker Mfg. Co., Springfield, Ill.
- \*Cleveland Tractor Co., Cleveland, O.
- \*Good Roads Machinery Co., Philadelphia, Pa.
- \*Holt Mfg. Co., Peoria, Ill.
- Toy Co., W. M., Sidney, Ohio.
- J. T. Tractor Co., Cleveland, O.
- Owensboro Ditcher & Grader Co., Owensboro, Ky.

### SPREADERS, STONE

- \*Austin-Western Road Mchy. Co., Chicago, Ill.
- \*Burch Flows Works Co., Crestline, O.

### STACKS, STEEL

- \*Chicago Bridge & Iron Works, Chicago, Ill.
- \*Conney & Co., Inc., Philadelphia, Pa.
- \*Hed Co., The, Milwaukee, Wis.
- \*Littleford Bros., Cincinnati, O.



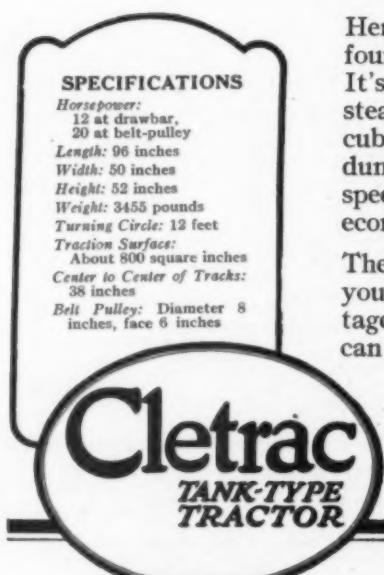
## Landscape Workers Use Cletracs For Faster, Better Grading

### SPECIFICATIONS

*Horsepower:*  
 12 at drawbar,  
 20 at belt-pulley  
*Length:* 96 inches  
*Width:* 50 inches  
*Height:* 52 inches  
*Weight:* 3455 pounds  
*Turning Circle:* 12 feet  
*Traction Surface:*  
 About 800 square inches  
*Center to Center of Tracks:*  
 38 inches  
*Belt Pulley:* Diameter 8  
 inches, face 6 inches

Here's a Cletrac doing the work of three or four teams—grading an athletic field at Chicago. It's working with a four-wheeled scraper at the steady Cletrac gait that never falters. Half a cubic yard of earth at a time is loaded and dumped by the pull of the tractor. Cletrac speed and low operating cost make it a big economy.

The Cletrac dealer near you will be glad to give you more information about Cletrac's advantages for all sort of contracting jobs—or you can write direct to us.



**THE CLEVELAND TRACTOR CO.**

*"Largest Producers of Tank-Type Tractors in the World"*

19211 Euclid Ave.

Cleveland, Ohio.

Blaw-Knox Co., Pittsburgh, Pa.  
Chatta. Boiler & Tank Co., Chattanooga, Tenn.  
Honhorst Co., Inc., Cincinnati, O.  
Petroleum Iron Works Co., Sharon, Pa.  
Scaife & Sons Co., Wm. B., Pittsburgh, Pa.  
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

**STEAM SHOVELS.** (See Shovels, Steam)

**STANDPIPES, TANKS AND TOWERS**

\*Chicago Bridge & Iron Works, Chicago, Ill.  
\*Connery & Co., Philadelphia, Pa.  
\*Fairbanks, Morse & Co., Chicago, Ill.  
\*Pacific Tank & Pipe Co., San Francisco, Cal.  
\*Pittsburgh Des Moines Steel Co., Pittsburgh, Pa.  
\*United Iron Works Co., Kansas City, Mo.  
Blaw-Knox Co., Pittsburgh, Pa.  
Caldwell Co., W. E., Louisville, Ky.  
Chattanooga Bld. & Tank Co., Chattanooga, Tenn.  
Eagle Tank Co., Chicago, Ill.  
Lancaster Iron Wks., Lancaster, Pa.  
Petroleum Iron Works Co., Sharon, Pa.  
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

**STEAM TURBINES**

\*Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
\*DeLaval Steam Turbine Co., Trenton, N. J.  
\*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.  
Ingersoll-Rand Co., New York.

**STEEL PLATE CONSTRUCTION**

\*Chicago Bridge & Iron Works, Chicago, Ill.  
\*Heil Co., The, Milwaukee, Wis.  
\*Hiltzal Steel Farm & Iron Co., Warren, O.  
\*Littleford Bros., Cincinnati, O.  
\*Pittsburgh Des Moines Steel Co., Pittsburgh, Pa.  
Bethlehem Steel Bridge Co., Bethlehem, Pa.  
Biggs Boiler Wks., Akron, O.  
Birmingham Steel Corp., Birmingham, Ala.  
Blaw-Knox Co., Pittsburgh, Pa.  
Chatta. Boiler & Tank Co., Chattanooga, Tenn.  
McClintic-Marshall Co., Pittsburgh, Pa.  
Pennsylvania Bridge Co., Beaver Falls, Pa.  
Petroleum Iron Works Co., Sharon, Pa.  
Riter-Conley Co., Pittsburgh, Pa.  
Scaife & Sons, Wm. B., Pittsburgh, Pa.  
Toledo Crane Co., Toledo, O.  
Union Iron Works, Hoboken, N. J.  
Vulcan Iron Works, Jersey City, N. J.  
Walsh & Weidner Boiler Co., Chattanooga, Tenn.

**STOKERS, MECHANICAL**

\*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.  
Babcock & Wilcox Co., N. Y. U.

**STREET LAMP POSTS**

\*Electric Railway Equipment Co., Cincinnati, O.  
\*General Elec. Co., Schenectady, N. Y.  
\*King Mfg. Co., Chicago, Ill.  
\*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.  
\*Union Metal Mfg. Co., Canton, O.

**STREET AND ROAD SIGNS.** (See Signs, Street and Road.)

**STREET CLEANERS AND PLUSHERS**

\*Austin-Western Road Mch'y. Co., Chicago, Ill.  
Eigin Sales Corp'n., New York.  
Federal Motor Truck Co., Detroit, Mich.  
Good Roads Machinery Co., Philadelphia, Pa.  
Municipal Supply Co., South Bend, Ind.  
Rochester Can Co., Rochester, N. Y.  
Thompson-Fleming Co., Inc., Buffalo, N. Y.  
Tiffin Wagon Co., Tiffin, O.  
Universal Road Mch'y. Co., Kingston, N. Y.  
White Company, Cleveland, O.  
Autocar Co., Ardmore, Pa.  
Etnyre & Co., E. D., Oregon, Ill.  
Four Wheel Drive Auto Co., Clintonville, Wis.  
Service Motor Truck Co., Wabash, Ind.

**STRUCTURAL, STEEL AND IRON.** (See Bridges and Buildings)

**STUMP PULLERS**

Bennett & Co., H. L., Westerville, O.  
Carpenter & Co., Geo. B., Chicago, Ill.  
Clyde Iron Works, Duluth, Minn.  
Lewis & Valentine, Roslyn, L. I.  
Thomas Elevator Co., Chicago, Ill.

**SURVEYORS' INSTRUMENTS.** (See Instruments.)

**TABLES AND BOARDS, DRAWING.** (See Drawing Materials.)

**TAMPING MACHINES**

\*Fawling & Harnischfeger Co., Milwaukee, Wis.  
Construction Mach'y Co., Waterloo, Ia.

\* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.

**TANKS, AIR COMPRESSOR**

\*Chicago Bridge & Iron Works, Chicago, Ill.  
\*Connery & Co., Inc., Philadelphia, Pa.  
\*Heil Co., Milwaukee, Wis.  
\*Indiana Air Pump Co., Indianapolis, Ind.  
\*Littleford Bros., Cincinnati, O.  
\*Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.  
\*Worthington Pump & Machy. Corp., New York.  
Abendroth & Root Mfg. Co., New York.  
Biggs Boiler Wks., Akron, O.  
Ingersoll-Rand Co., New York.  
Lancaster Iron Wks., Lancaster, Pa.  
National Tube Co., Pittsburgh, Pa.  
Petroleum Iron Works Co., Sharon, Pa.  
Scaife & Sons Co., W. B., Pittsburgh, Pa.  
Westinghouse Tract. Brake Co., Wilmerding, Pa.

**TANKS, OIL.** (See Oil Tanks.)

**TANKS, STEEL**

\*Chicago Bridge & Iron Works, Chicago, Ill.  
\*Connery & Co., Inc., Philadelphia, Pa.  
\*Heil Co., Milwaukee, Wis.  
\*Littleford Bros., Cincinnati, O.  
\*Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.  
Biggs Boiler Wks., Akron, O.  
Caldwell Co., W. E., Louisville, Ky.  
Chatta. Boiler & Tank Co., Chattanooga, Tenn.  
Columbian Steel Tank Co., Kansas City, Mo.  
Hardesty Mfg. Co., R., Denver, Col.  
Lancaster Iron Works, Lancaster, Pa.  
Petroleum Iron Works Co., Sharon, Pa.  
Scaife & Sons, Wm. B., Oakmont, Pa.

**TANKS, WOOD**

\*Pacific Tank & Pipe Co., San Francisco, Cal.  
Caldwell Co., W. E., Louisville, Ky.  
Davis Co., G. M., Palatka, Fla.  
Eagle Tank Co., Chicago, Ill.  
Hauser-Stander Tank Co., Cincinnati, O.  
Kalamazoo Tank & Silo Co., Kalamazoo, Mich.  
National Tank & Pipe Co., Portland, Ore.  
Redwood Manufacturers Co., San Francisco, Calif.  
Scaife & Sons, Wm. B., Oakmont, Pa.  
Stearns Lumber Co., A. T., Boston, Mass.  
U. S. Wind Engine & Pump Co., Batavia, Ill.  
Wendlandt & Co., Chicago, Ill.

**TANK WAGONS**

\*Acme Road Mach. Co., Frankfort, N. Y.

**TAPES, STEEL AND METALLIC**

\*Kolessch & Co., New York.  
Dietrichs Co., Eugene, New York.  
Keuffel & Esser Co., Hoboken, N. J.  
Lufkin Rule Co., Saginaw, Mich.  
Starrett, L. S., Athol, Mass.

**TAR**

\*Barrett Co., New York.

**TAR KETTLES.** (See Kettles.)

**TIES, STEEL**

\*Koppel Industrial Car & Equip. Co., Koppel, Pa.  
Carnegie Steel Co., Pittsburgh, Pa.  
Sweet's Steel Co., Williamsport, Pa.

**TIRES, RUBBER.** (For Motor Trucks.)

\*Kelly Springfield Tire Co., New York.  
Firestone Tire & Rubber Co., Akron, O.  
Goodrich Rubber Co., B. F., Akron, O.  
Goodyear Tire & Rubber Co., Akron, O.  
Republic Rubber Co., Youngstown, O.  
U. S. Tire Co., New York.

**TOOL HOUSES, PORTABLE STEEL**

\*Littleford Bros., Cincinnati, O.

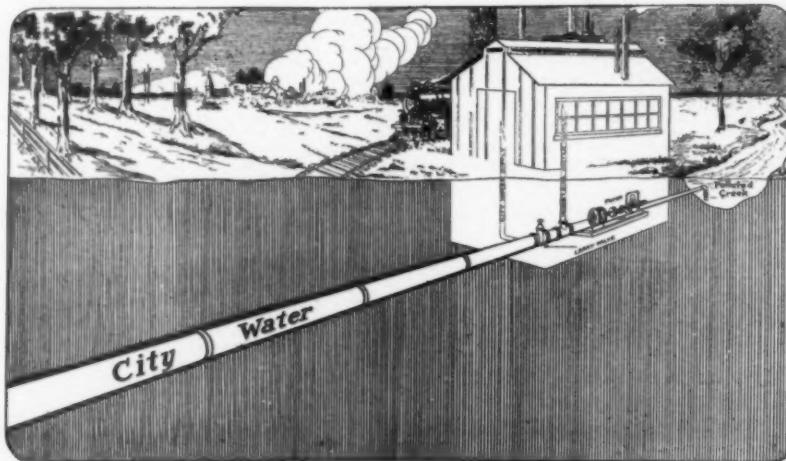
**TOWERS** (See Standpipe Tanks and Towers)

**TRACKS, INDUSTRIAL AND PORTABLE**

\*Koppel Ind. Car & Equipment Co., Koppel, Pa.  
Chase, Fdry. & Mfg. Co., Columbus, O.  
Eaton Car & Consin. Co., New York.  
Hunt Co., Inc., C. W., West New Brighton, N. Y.  
Lakewood Engineering Co., Cleveland, O.  
Light Railway Equipment Co., Philadelphia, Pa.

**TRACTORS**

\*Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
Cleveland Tractor Co., Cleveland, O.  
Dayton-Dowd Co., Quincy, Ill.  
\*Fairbanks, Morse & Co., Chicago, Ill.  
\*Holt Mfg. Co., Peoria, Ill.  
\*White Company, The, Cleveland, O.



*The valve separating an impure industrial water supply from a pure city water supply leaked. Typhoid followed.*

## The Railroad Shops at Bloomington, Illinois

had a dual water supply, one for drinking; the other for industrial purposes, fire protection, etc. The first was a pure, safe water obtained from the city water main, the second a polluted, unsafe disease laden water pumped from a nearby creek.

In the shops the two systems were connected so that in case of need the industrial system could obtain water from city mains, the two being separated by a valve.

But this valve leaked!

What happened?

Why the defiled, murderous creek water passed through the leaky valve, entered the city water system, polluted the supply and caused—

\*15 deaths

130 cases of typhoid fever

400 cases of intestinal trouble

And it all could have been prevented—all the suffering—the loss—the heartache avoided! had the industrial supply been chlorinated!

One ounce of chlorine costing three-fourths of a cent would have made twelve thousand

gallons of that creek water disease proof, would have made it incapable of spreading pestilence and death.

And the W & T Apparatus to introduce the chlorine to the water would have cost about five hundred dollars.

All industrial water supplies should always be chlorinated, cross connections between drinking water supplies and industrial water supplies should never be permitted unless the latter is sterilized.

Liquid Chlorine made from salt by Niagara's Electricity is an absolutely pure chemical. It in no way alters the water to which it is applied. But it does make it safe, it kills the minute germs in the water, the germs that come from pollution and that cause disease.

There are over four thousand installations of Wallace & Tierman Apparatus every day making over three billion gallons of water safe to drink.

If the water you drink is not sterilized, tell us the name of your water superintendent so that we may send him our book "Why Sterilize Water?"

\*Reference—Eng. News Record—May 13, 1920.

## WALLACE & TIERNAN CO., Inc. NEWARK, NEW JERSEY



Chicago  
Pittsburgh

### BRANCH OFFICES

Atlanta  
Dallas

San Francisco  
Kansas City



Advance-Rumely Thresher Co., Laperte, Ind.  
 Avery Co., Peoria, Ill.  
 Bates Machine & Tractor Co., Joliet, Ill.  
 Best Tractor Co., C. L., San Leandro, Cal.  
 Case Threshing Machine Co., J. L., Racine, Wis.  
 Clark Tractor Co., Chicago, Ill.  
 Dart Truck & Tractor Corp., Waterloo, Ia.  
 Four Wheel Drive Auto Co., Clintonville, Wis.  
 Hart-Parr Co., Charles City, Iowa.  
 Huber Mfg. Co., Marion, O.  
 J. T. Tractor Co., Cleveland, O.  
 Oliver Tractor Co., Knoxville, Tenn.  
 Selden Truck Corp'n., Co., Wabash, Ind.  
 Service Motor Truck Co., Wabash, Ind.  
 Watson Products Corp., Canastota, N. Y.

**TRAILERS FOR MOTOR TRUCKS**

\*Arcadia Trailer Corp., Newark, N. Y.  
 \*Lee Trailer & Body Co., Chicago, Ill.  
 Eagle Wagon Works, Auburn, N. Y.  
 Highway Trailer Co., Edgerton, Wis.  
 Troy Wagon Works, Troy, O.  
 Warner Mfg. Co., Beloit, Wis.  
 Watson Products Corp'n., Canastota, N. Y.

**TRAILERS, INDUSTRIAL**

\*Lee Trailer & Body Co., Chicago, Ill.  
 Chase Fdry. & Supply Co., Columbus, O.  
 Electric Wheel Co., Quincy, Ill.  
 Lakewood Engineering Co., Cleveland, O.

**TRAMWAYS, AERIAL WIRE ROPE**

Broderick & Basson Rope Co., St. Louis, Mo.  
 Leschen & Sons Rope Co., A., St. Louis, Mo.

**TRANSFORMERS**

\*Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
 \*General Electric Co., Schenectady, N. Y.  
 \*Westinghouse Elec. & Mfg. Co., E. Pitts'gh, Pa.  
 Kuhlmel Electric Co., Bay City, Mich.

**TRANSITS AND LEVELS. (See Instruments.)**

**TRANSMISSION MACHINERY, POWER**  
 \*Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
 \*General Electric Co., Schenectady, N. Y.  
 Dodge Mfg. Co., Mishawaka, Ind.  
 Link Belt Co., Chicago, Ill.  
 Webster Mfg. Co., Chicago, Ill.  
 Weller Mfg. Co., Chicago, Ill.

**TREADS, SAFETY**

American Mason Safety Tread Co., Boston, Mass.  
 Concrete Steel Co., New York.  
 Irving Iron Works, Long Island City.

**TRENCH EXCAVATORS, (see Excavators, Ditch & Trench)**

**TURBINES**

\*Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
 \*De Laval Steam Turbine Co., Trenton, N. J.  
 \*General Electric Co., Schenectady, N. Y.  
 \*Midwest Engine Co., Indianapolis, Ind.  
 \*Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.  
 Ingersoll-Rand Co., New York.

**USED MACHINERY**

\*Briggs, Inc., Marvin, Bkln., New York.  
 \*Craven Co., Frank T., New York.  
 \*Forsyth Bros., New York.  
 \*King, Philip T., New York, N. Y.  
 \*Titan Equipment Co., New York, N. Y.  
 \*Zelnicker Supply Co., Walter A., St. Louis, Mo.

**VALVE CONTROL APPARATUS, ELECTRIC**

\*Payne Dean Ltd., New York.

**VALVES, GATE AND INDICATOR POSTS**

\*Crane Company, Chicago, Ill.  
 \*Eddy Valve Co., Waterford, N. Y.  
 \*Kennedy Valve Mfg. Co., Elmira, N. Y.  
 \*Ludlow Valve Co., Troy, N. Y.  
 \*Norwood Engineering Co., Florence, Mass.  
 \*Pratt & Cady Co., Inc., Hartford, Conn.  
 \*Rensselaer Valve Co., Troy, N. Y.  
 \*Smith Mfg. Co., A. P., East Orange, N. J.  
 \*Wood & Co., R. D., Philadelphia, Pa.  
 Chapman Valve Mfg. Co., Indian Orchard, Mass.  
 Darling Valve Mfg. Co., Williamsport, Pa.  
 Fairbanks Co., The, New York.  
 Iowa Valve Co., Oskaloosa, Ia.  
 Lunkensheimer Co., Cincinnati, O.

\*Indicates that the manufacturer carries an advertisement. See index facing inside back cover.

**VALVE BOXES AND HOUSINGS**

\*Central Foundry Co., New York.  
 \*Clark Co., H. W., Mattoon, Ill.  
 \*Columbian Iron Works, Chattanooga, Tenn.  
 \*Eddy Valve Co., Waterford, N. Y.  
 \*Kennedy Valve Mfg. Co., Elmira, N. Y.  
 \*Ludlow Valve Co., Troy, N. Y.  
 \*Mueller Mfg. Co., H. Decatur, Ill.  
 \*Pratt & Cady Co., Inc., Hartford, Conn.  
 \*Rensselaer Valve Co., Troy, N. Y.  
 \*Smith Mfg. Co., A. P., East Orange, N. J.  
 \*U. S. C. Ir. Pipe & Fdry. Co., Burlington, N. J.  
 \*Wood & Co., R. D., Philadelphia, Pa.  
 Chapman Valve Mfg. Co., Indian Orchard, Mass.  
 Clow & Sons, J. B., Chicago, Ill.  
 Darling Valve Mfg. Co., Williamsport, Pa.  
 Fairbanks Co., The, New York.  
 Iowa Valve Co., Oskaloosa, Ia.  
 S. E. T. Valve & Hydrant Co., New York.

**VENTILATORS**

American Blower Co., Detroit, Mich.  
 Edwards Mfg. Co., Cincinnati, O.  
 Milwaukee Corrugating Co., Milwaukee, Wis.

**WAGONS AND TRUCKS**

\*Lytle Culv. & Rd. Equip. Co., Minneapolis, Minn.  
 \*Russell Grader Mfg. Co., Minneapolis, Minn.  
 \*Tiffin Wagon Co., Tiffin, O.  
 \*White Company, The, Cleveland, O.  
 Acme Wagon Co., Emigsville, Pa.  
 Eagle Wagon Works, Auburn, N. Y.  
 Troy Wagon Works, Troy, O.  
 Watson Products Corp'n., Canastota, N. Y.  
 Western Wheeled Scraper Co., Aurora, Ill.

**WAGON BODIES. (See Dump Bodies)**

**WAGON LOADERS. (See Loaders, Gravel and Wagon)**

**WALLBOARD**

\*Carey Co., Philip, Cincinnati, Ohio.  
 Beaver Board Companies, Buffalo, N. Y.  
 Bird & Son E. Walpole, Mass.  
 Cornell Wood Products Co., Chicago, Ill.  
 Haverhill Box Board Co., Haverhill, Mass.  
 McAndrews & Forbes Co., New York, N. Y.  
 Plasteron Wallboard Co., Buffalo, N. Y.  
 Upson Co., The, Lockport, N. Y.  
 Waldorf Paper Products Co., St. Paul, Minn.

**WALL TIRES**

\*Niagara Metal Stamp. Corp., Niagara Falls, N. Y.  
 Concrete Steel Co., New York, N. Y.  
 Berger Mfg. Co., Canton, O.  
 Milwaukee Corrugating Co., Milwaukee, Wis.

**WATER MAIN CLEANING**

\*National Water Main Cleaning Co., New York.

**WATER MAIN TAPPING MACHINES**

\*Mueller Mfg. Co., H. Decatur, Ill.

\*Smith Mfg. Co., A. P., E. Orange, N. J.

**WATER METERS. (See Meters, Water and Oil)**

**WATERPROOFING COMPOUNDS AND MATERIAL**

\*Barber Asphalt Paving Co., Philadelphia, Pa.

\*Barrett Company, New York.

\*Carey Company, Philip, Cincinnati, O.

\*Standard Oil Co. of Indiana, Chicago, Ill.

\*Texas Company, New York.

\*Truscon Steel Co., Youngstown, O.

\*Anti-Hydro Waterproofing Co., New York.

\*Atlantic Refining Co., Philadelphia, Pa.

\*General Fireproofing Co., Youngstown, O.

\*Graniter Corp., New York.

\*Horn Co. A. C., Long Island City, N. Y.

\*Master Builders Co., Cleveland, O.

\*Minwax Co., The, New York.

\*Protexol Corp., New York.

\*Ruberoid Co., New York.

\*Sonneborn Sons, Inc., New York.

\*Tock Brothers, New York.

**WATER PURIFICATION**

\*Electro Bleaching Gas Co., New York.

\*Hoover Electrochemical Co., New York.

\*Mathieson Alkali Works, Inc., New York.

\*Norwood Eng. Co., Florence, Mass.

\*Penns. Salt Mfg. Co., Philadelphia, Pa.

\*Pittsburgh Filter & Eng. Co., Pittsburgh, Pa.

\*R. U. V. Company, New York.

\*Wallace & Tierman Co., Inc., New York.

\*Clow & Sons, J. B., Chicago, Ill.

\*Permutit Co., New York.

\*Seafle & Sons Co., Wm. B., Pittsburgh, Pa.

## The Mathieson Alkali Works, Inc.

WORKS  
Niagara Falls, N. Y.

General Offices  
25 WEST 43rd STREET  
New York City

WORKS  
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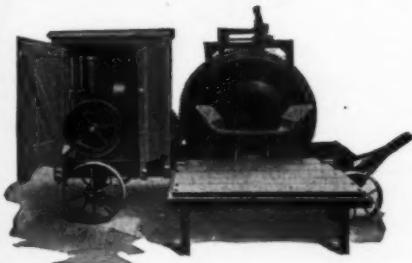
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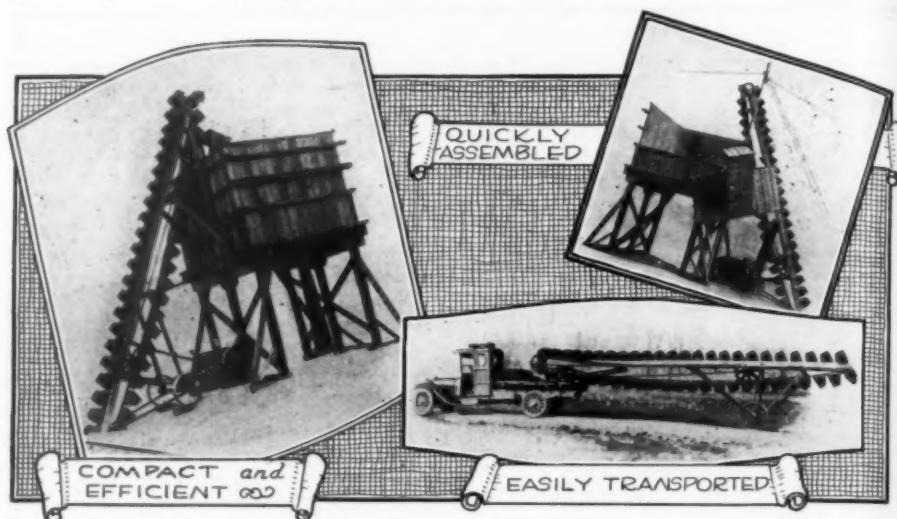
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## TABLE OF CONTENTS FOR MAY, 1921

### EDITORIAL

Laying Cast Iron Water-Mains in a Rough Country.....	41
Preparing Subgrade by Machinery.....	46
What the Road Program Means to Labor.....	46
Suggestions for Asphalt Paving Contractors—Part II.....	47
The Functions of the Engineer.....	54
The Transportation Requirements of the Contractor.....	55
Giant Road Leveler for Use with Heavy-Duty Tractors.....	59
The Public and Professional Obligations of the Engineer.....	60
Every Catalog Especially Selected.....	61
Contractors', Engineers' and Manufacturers' Notes.....	63
Contractors' Machinery and Trucks.....	64
Beverly Adds to Penetration Roads System.....	66
Traction Tread in Demand for Pavers.....	67
Jacks for Contracting Service.....	68
New Road Maintainer .....	68
An Electrically Equipped Hydraulic Dredge.....	72
A Truck for Heavy Haulage.....	74
Shovel Attachments for Excavators.....	76
Bridges Painted for Preservation.....	76



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# Contractors' & Engineers' Monthly

New York

May, 1921

## Laying Cast Iron Water-Mains in a Rough Country

By F. S. Tainter

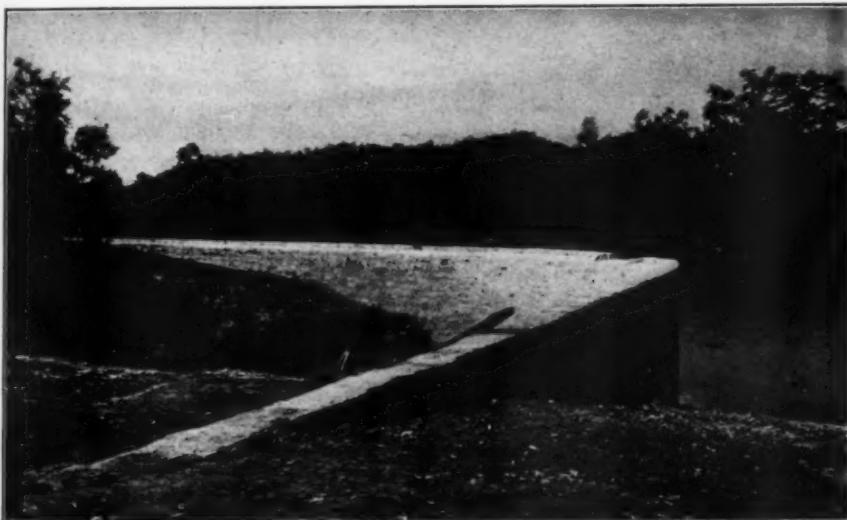
Consulting Engineer; Lieutenant-Colonel, Engineers, U. S. R.

**I**N 1915-16 the writer had two very interesting problems to solve connected with high-head gravity water-supply mains in the mountains of Eastern Tennessee and Western Virginia, and it is believed that a brief account of what was done and why it was done will prove both interesting and instructive.

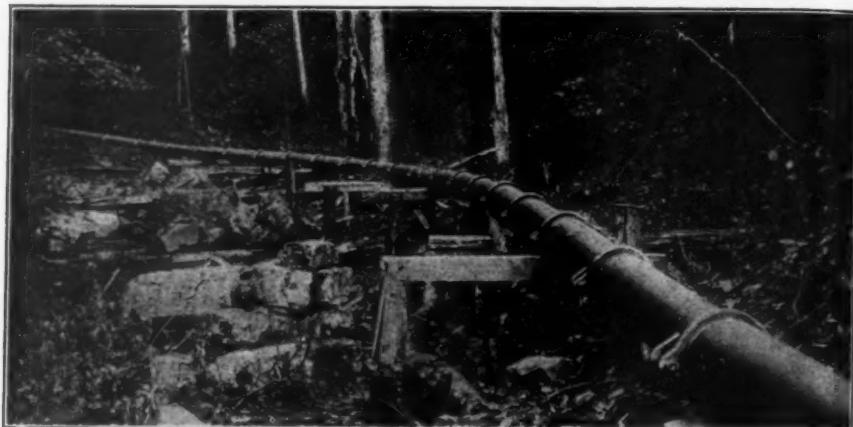
The industrial city of Kingsport, Tenn., which is located on a plateau some 1,200 feet above sea-level between the north and south branches of the Holston River, and just under the towering peak of the Cumber-

land Mountains known locally as Bays Mountain, although now a fast-growing city of some 15,000 inhabitants, was in 1915 a village of but a few hundred. At that time it was precariously supplied with water through the help of the Clinchfield Portland Cement Company and a few springs and wells controlled by different parties who allowed the public the use of such water as they did not need. This water was all hard, being developed from springs and wells in a region abounding in limestone.

Even at this date the great future of



THE DAM AT THE HEAD OF A ROCKY GORGE—THE SOURCE OF THE KINGSPORT, TENN., WATER-SUPPLY



THE KINGSPORT PIPE LINE CROSSING A GORGE, SHOWING TEMPORARY WOODEN SUPPORT

Kingsport, because of its location in a section of great fertility, and its proximity to almost all base materials needed for manufacture, as well as rich near-by coal mines, seemed to its guiding spirits to be assured, so it was decided to lay out the city along modern lines and establish public improvements commensurate with the population which seemed bound to come. To that end an effort was made to obtain a supply of soft, potable water in such quantity as would take care of the growth of such a city for a long time to come.

#### The Source of Supply

The investigations following this determination were finally rewarded by the discovery of an upland meadow some six miles away, lying at the head of a rocky gorge cutting into the northerly side of Bays Mountain. This meadow at elevation 1,800 plus had an area of some thousand acres and a watershed of some 3 miles, and was almost entirely surrounded by the inner slopes of the mountain, whose rampart-like crest formed a periphery unbroken except where a small stream resulting from several mountain springs traversed the meadow-land and broke through its walls at a point where the gorge indented the upper line of table-land. Careful examination showed that this water was of sandstone origin, and that it was both soft and pure because of a peculiar geological condition of change in the structure of the mountain at about elevation

1,500. Below this the entire base of the mountain, including its foot-hills, escarpments and plateaus, is composed entirely of limestone, clay and shale, while abruptly above, and so on to the highest points, the rest is sandstone of a beautiful creamy white color, analyzing about 98.5 quartzite.

As the flow of the stream was found, like nearly all streams in latitude  $34^{\circ}$ - $36^{\circ}$  north, to run low in summer, it was decided to build a large catchment and storage reservoir so that advantage might be taken of the mean flow, and through storage the reserve of an ample watershed might be put positively on the credit side of the city's supply. Accordingly, a 50-foot dam was built at the head of the gorge, and a reservoir of some 300 million gallons capacity was created.

The fact that this reservoir was at elevation 1,850 plus, with the point of delivery to the city at elevation 1,200 plus, emphasized the necessity of a careful alignment and profile for the 6 miles of pipe line needed for the proposed service, and this was accordingly made. It showed a very precipitous fall from its initial point at the dam on the chosen line through the gorge to the foot of the mountain, the actual distances and elevations being as follows: surface of water in reservoir, elevation 1,851.72; 500 feet from dam, elevation 1,700.0; 1,000 feet from dam, elevation 1,600.0; 1,500 feet from dam, 1,500.0; 2,000 feet from dam, elevation 1,450.0; 2,500 feet from dam, elevation 1,400.0.

#### A Difficult Proposition

This chosen line, which was actually the only one possible, was, besides being precipitous, extremely rough, jagged and broken, and in addition was crossed at irregular intervals and angles by small and deeply indented lateral creases or folds, necessitating in places serious bridging and pier work in order to maintain anything like a satisfactory alignment. The remainder of the line, while difficult to determine because of badly broken foot-hills, dangerous marshes, numerous creeks, and river crossings, was finally adjusted so that a fairly steady grade with no local summits was obtained to Station 310 + 50 at the edge of the city, or 31,050 feet from the dam, where the elevation for the initial point for distribution was 1,220 plus feet, thus showing a pressure to be expected of approximately 250 pounds, and determining, of course, the weight of pipe at or about that level. In its working out, the line actually developed a pressure at Station 310 of 272.6 pounds, and necessitated the installation of a pressure-reducing valve at about that point, which after connection maintained a working pressure for the city of 125 pounds while showing 270 + pounds on the pressure side.

It having been determined for sake of

longevity, and freedom from repair work, to use cast iron pipe, a pipe of 10-inch diameter was selected as the size necessary for delivering the maximum quantity of water then thought likely to be needed. These two points having been settled, the question immediately arose as to how the heavy 12-foot lengths of cast iron pipe could be delivered along an alignment running through such a terrain as has been lightly described, and particularly how at anything like reasonable cost the pipe could be delivered and handled on the steep slope of the mountain for the first 2,500 feet out from the dam. The matter of lead jointing and calking on such a steep slope and through so many marshes and creek and river crossings was also exceedingly bothersome in contemplation. The mountain part of the line was practically unattainable with heavy loads, and four-fifths of the remainder was almost inaccessible for even light loads because of the many marshes and many bothersome sweeps and bends of the large stream crossed and recrossed by the located line.

#### The Choice of Pipe

At this juncture it was decided to use Universal Joint pipe, which was accordingly specified, thus cutting in two the weight of each pipe handled, and entirely eliminating



THE LINE AT THE SAME POINT SHOWN ON PREVIOUS PAGE AFTER THE PERMANENT STONE PIERS HAD BEEN ERECTED

the expensive item of lead and oakum calking. Universal Joint cast iron pipe, as is well known, is made up in standard 6-foot lengths with machined male and female ends, which, fitting exactly together, are held in place by non-corrosive bolts passing through holes in the two cast iron ears which are part of each pipe. The pipe are easily and skillfully laid by ordinary labor, which after a day or two of experience becomes very skillful; indeed, it has been found that a line laid by such a force showed much less percentage of defective joints than the average bell-and-spigot line laid by expensive union pipe fitters. It was also found that the Universal pipe once properly laid was actually cemented together by a quick-forming red rust just outside of the white-leaded machined ends, and that in the laying of a line in a badly broken country the short lengths, combined with a safe deflective at each joint far in excess of that allowed on standard B and S lines, helped materially in laying the pipe on a tortuous alignment.

In practice the pipe was received from the Bessemer, Ala., foundry of the Central Foundry Company of New York, by car-load lot, and stocked by weights in a receiving and distribution yard established by the contractors (the H. C. Brooks Company, of Martinsburg, W. Va.) at a convenient point near the crossing of the proposed pipe line and the tracks of the Clinchfield, Carolina and Ohio Railroad Company; from there it was peddled out over the line as required. Beginning at the dam with light-weight pipe, the weights were gradually increased as demanded by the increasing head until 250 pounds pressure was reached, and from that point on an even weight of pipe was strictly adhered to, with the one exception of crossing the Holston River. Here 500 feet of special 300-pound pressure Universal Joint cast iron pipe was used.

As the Universal cast iron pipe was made up in 6-foot lengths weighing only one-half as much as the ordinary 12-foot lengths of bell-and-spigot pipe, it was possible to negotiate the difficult portions of the line, and the contractors proceeded with great intelligence and dispatch with the general installation. Their method was to prepare for the reception of the pipe with one gang of men who always kept well ahead of the actual pipe-laying gang—a thing not nearly as easy to do as it sounds, but notwithstanding the rough nature of the country the actual

pipe laying averaged about 750 feet per day, the number of men in the pipe gang being 6 laborers and a foreman.

The pipe laid on the steep sections of the mountain portion was anchored every 50 feet by large rubble piers through which it passed, and in gorge crossings, of which there were many, the line was supported on rubble columns built 12 feet on centers, with pipe laid so as to cantilever out and support the central, or tie, joint.

The swamp and creek crossings were all negotiated with ease and despatch, even the mules, which with special panier saddles helped transport the pipe one piece at a time to most difficult points, getting the general atmosphere of the job and doing their bit to make it successful.

#### Crossing the River

The river crossing, which prior to actual construction had been greatly dreaded, actually worked out with comparative ease, and was accomplished in the record time of three days. The pipe was laid in a trench dredged through the shingle bottom of the river to an average depth of about 28 inches, at which depth a shale rock was generally encountered. The crossing of about 500 feet in length was accomplished at the height of the dry season; in no part of the line was the water over 4 feet in depth, and generally it was much less. This allowed the laying gang to wade the entire crossing and to feed and ease the pipe off a cradle built on an angle on a scow which operated as a ferry held on the line by wire ropes and spaced idlers running on a tightly drawn cable extending from shore to shore. The two up-stream corners of the scow were supplied with guy lines operating at sufficient angles with shore pulleys to hold any necessary position, and the motive power was had by either hitching up on the main cable, or by poling—usually the latter.

After feeding out and laying the entire line across the river, a man, or, as he worked out, a man-fish, examined and tightened every joint, after which the governing valves on the inshore ends were turned and the line tested out under a pressure of 270 plus pounds. No leak or bad joint being disclosed, the trench was closed by a shingling immediately over the pipe, of cement bags filled with coarse concrete, and roof lapped with the flow of the river. On top of this the dredged shingle of the river bed, which

had been left in a winrow, was raked back and left in as nearly a natural condition as possible.

No trouble has been experienced with this line, although it has been carrying over 270 pounds pressure now for over five years. Indeed, this statement applies to the whole system, on which trouble has been far lower than is usually expected and encountered. Joint trouble over the entire system—that is, both main and distribution (the latter being also laid with Universal pipe and comprising some 80,000 feet)—has been practically nil, and except for the usual number of defective castings or hair-cracked pipe, no trouble or expense has been incurred.

#### Another Installation

The great success attending the development and use of the Kingsport water-supply attracted the attention of officials of the Virginia Coal and Iron Company, who at that time were anxious to develop a gravity supply of water for a number of their collieries and colliery towns lying in the Powell Creek Valley several miles above Big Stone Gap, Wise County, Va., and the writer was consulted and intrusted with the design.

The general conditions governing the development of the supply for this particular section were found to be very similar to those which have just been described, and it was accordingly decided to again use Universal Joint cast iron pipe. Briefly, the general layout was about as follows: A mountain meadow with a rather limited watershed, but also fed by several springs, was discovered at elevation 2,300 on the upper slopes of Big Stone Mountain. A dam was drawn across a gorge governing this meadow and through which the small stream transversing it had heretofore found its way, and a storage reservoir was created with a crest at elevation 2,358.6, effecting a storage of approximately seventy-five million gallons of water. From the reservoir so built to the foot of the mountain, at which point Powell's Creek had to be crossed, was a distance of about 4,000 feet, and as the elevation of the bottom of the creek was approximately 1,600, the fall was precipitous; in fact, if anything, it was a more precipitous and rugged descent than that of Bay's Mountain. At places the pipe ran over the side of cliffs which had to be benched in and the pipe anchored with heavy straps tightly embedded in the rock, and at the bottom

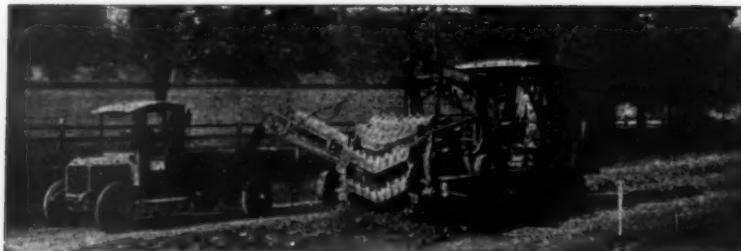


A STEEP SECTION OF THE LINE, SHOWING ANCHOR BLOCKS

large rubble stone abutments had to be constructed to take up the thrust.

The pipe, starting at light pressure at the reservoir, arrived at the Powell Creek crossing with special weight pipe designed to withstand 350 pounds pressure. From that point on to the several places of distribution heavy pressure pipe was used. In all, on the distribution supply lines there was approximately 35,000 feet of pipe laid. The actual local supply for each colliery or each colliery town was arranged for by a lateral leading from the main to a small distributing reservoir set at proper height to give the desired pressure for the local consumption, and the feed was regulated by especially designed lever or float valves.

This system was put in just prior to the war and has been in successful operation ever since. It has had practically no trouble of any kind other than a few split pipe or defective castings, which have been replaced as they developed. But even with these, the percentage of repair or replacement has been well below the average for any supply line or distribution system that the writer has encountered in many years.



ON THE MONTGOMERY COUNTY, PA., ROAD WORK A KOEHRING EXCAVATOR  
WAS USED TO GOOD ADVANTAGE  
It is here shown making a 10-inch cut in macadam

## Preparing Subgrade by Machinery

THE Union Paving Company of Philadelphia has had under construction the improvement of the old York Road in Montgomery County, Pa., by paving with reinforced concrete 20 feet wide, 6 inches thick at the side, and 8 inches thick at the center. The length of the pavement when completed is to be 29,860 feet.

The old road surface on this contract was of Telford, macadam and some cinder concrete, there being various sections of each of these materials. The macadam sections were of the bituminous penetration and bituminous surface treatment types.

As there were no cuts over 18 inches deep on the entire job, the contractor determined to make the subgrade excavation by means of a Koehring excavator. The material of the old roadway was first loosened by means of a scarifier drawn by a steam roller. The excavator follows and picks up the loosened material and delivers it to motor trucks which drive alongside the excavator. The material in the macadam sections of the old road was salvaged for use elsewhere, and in some instances this

made it necessary to make two successive cuts to separate the materials. This reduced the daily output of the machine considerably.

The equipment excavated about 1,000 square yards of road surface in 10 hours, which was approximately twice as fast as the operations of laying the pavement. The crew required for the excavating operations was as follows:

1 foreman  
1 steam roller operator  
1 excavator operator  
3 laborers steadyng the scarifier and grinding teeth  
1 general utility man

It is possible to install a screen inside the revolving knives of the excavator and above the conveyor which discharges the material into the trucks alongside, and by means of this screen the coarse material in the old macadam can be separated from the fine dust, if desired, and the latter be deposited on the subgrade or at the sides of the cut.

## What the Road Program Means to Labor

About 700,000 men will be needed in building the 35,000 miles of new highways contemplated this year under the billion-dollar road program outlined by the Federal Government and the states and counties. Fully 300,000 more men will be needed in the quarries, gravel-pits, cement, brick and asphalt plants and factories devoted to the

manufacture of road machinery. To set an army of half a million men, now for the most part unemployed, at building highways is to solve in part not only the acute unemployment problem facing the nation, but also part of the rail troubles.

J. R. DRANEY,  
President, The Asphalt Association.

# Suggestions for Asphalt Paving Contractors\*

## Part II

By Henry B. Drowne

Division Engineer with The Lane Construction Corporation

### Placing and Spreading Materials

**I**N the construction of asphalt roads by the penetration method a considerable volume of the finer sizes of stone is required for covering the several applications of asphalt. This covering material is stacked on the shoulders of the road in small piles. Care should be taken not to make the piles too far apart, but to have several to each hundred feet. A man walking any distance with a shovelful of material before spreading it costs money. The piles should be near enough together so that such unnecessary labor will be avoided. Material which is to be placed on the shoulder should be brought on the job ahead of the material which is to be spread on the subgrade. Hauling methods and traffic requirements will determine the best method of spreading the stone.

Where stone is brought to the job in bottom-dump wagons, the labor of spreading may be lessened by chaining the bottoms so as to string the stone in windrows parallel to the road, and a road machine can then be used to spread the windrows across the road. Reversible dump-wagons are usually

built so as to spread the load at right angles to the center line of road, and by chaining the doors, the stone may be placed about as required. Some end-dump trucks are equipped with an arrangement on the tail boards so that the tail board opening is regulated as the truck is dumped. With a skilful operator a truck load can be spread quite uniformly at almost any desired depth and for the width of the truck body.

A stone-spreading device is made for use with dump trucks, which largely eliminates hand labor. This device consists of a hopper to which an adjustable V-shaped plow is attached. The hopper and plow are hitched close behind the truck, so that as the truck dumps the stone it falls into the hopper. As the truck moves along the road, the stone flows from the hopper through a gate and is spread to any desired width up to 16 feet by the V-shaped wings. The depth to which the stone is spread is controlled by the adjustable gate in the hopper, and by raising or lowering the plow wings. Courses as thin as two inches, loose measurement, have been spread with this device, so that a slight truing up by hand was all that was necessary to complete the work. The writer has found better results are obtained by making the maximum width of

\* EDITORIAL NOTE.—The text is reprinted by permission, from Brochure No. 13 of The Asphalt Association.



TWO TYPES OF BURCH STONE SPREADERS FOR DISTRIBUTING GRAVEL OR CRUSHED STONE EVENLY OVER THE SUBGRADE DIRECTLY FROM MOTOR TRUCKS

spreading at any one passage not over 10 or 12 feet.

Certain quarries can deliver stone by trolley. Usually stone cars are built especially for such work, that will dump the stone alongside the trolley track. Where a job parallels a trolley road on which stone may be received in such a manner, the best way to handle the delivery is by means of a team and scoop scraper.

Traffic requirements will sometimes necessitate constructing the road surface one-half at a time, and the methods used for placing the materials will have to be modified to meet the traffic conditions. Usually it is not wise to spread stone in such cases much faster than it can be covered with the bituminous material, since much extra labor is needed to reshape the stone after traffic has disturbed it.

Hot pavement mixtures are required to be dumped on the foundation course and rehandled by shovels to the point where the mixture is raked out. No other method to the writer's knowledge can be used. The nearer to the point of raking that the load can be dumped, the less will be the number of men required to rehandle the load. For this reason, if the mix is brought in 5-ton trucks, it is advisable to dump the load in two piles rather than one. Shovelling the mix is made easier if the loads are dumped on pieces of sheet steel.

#### Heating and Manipulation of Asphalt

Asphalt is furnished on the job in one of three ways, as follows: in barrels or drums, in tank cars, and in tank trucks. The type of construction and the equipment at hand will determine the best method to adopt. Material delivered in tank cars costs usually two to four cents less a gallon than material furnished in barrels or drums, and where the amount of material to be used is large, tank car deliveries should be taken advantage of. Work which is situated near a distributing station of an asphalt company can be supplied with the asphalt cheaper usually than in any other way by hauling the hot asphalt in tank trucks direct from the plant. Barrel shipments are warranted only when the quantity to be used is less than a tank car, or a service from a distributing station cannot be obtained. In hot mix work it may be more convenient in some cases to have the asphalt shipped in drums. As an illustrative case—when railroad transporta-

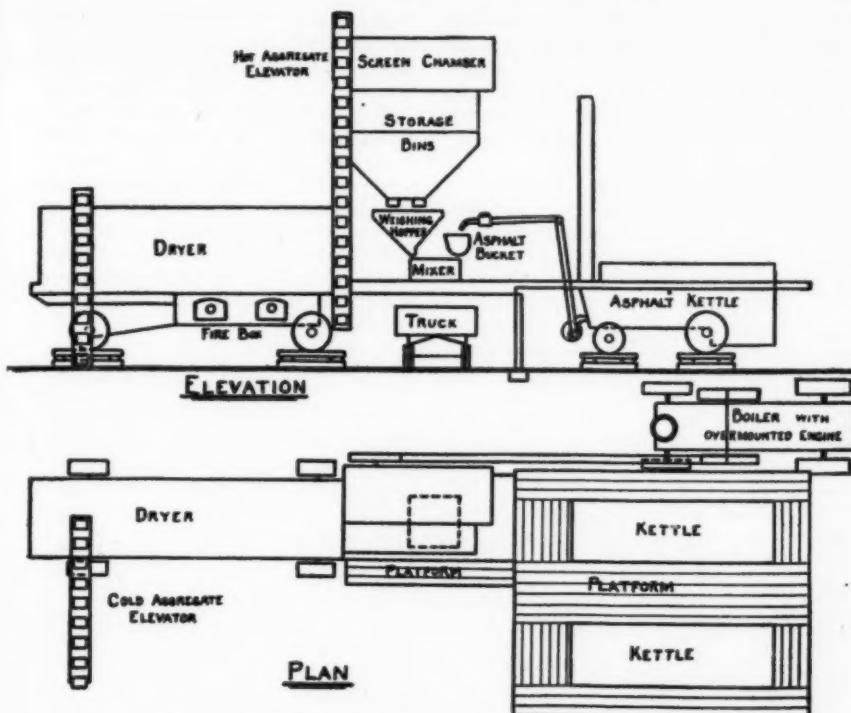
tion was uncertain, if all the asphalt required was shipped to the work in drums and stored, no delays would be incurred in waiting for asphalt, which might be the case if shipments were made in tank cars.

When asphalt is shipped in tank cars, steam for heating it can often be supplied from the boilers of some plant alongside of the siding on which the car is placed. The expense of such an arrangement is usually not great, and as such boilers carry a higher pressure and have a larger steam capacity than the portable boiler used by the contractor, the asphalt is heated more rapidly.

Where such an arrangement cannot be obtained, a portable boiler or road roller may be piped up to the car. The higher the steam pressure, the greater the efficiency obtained in heating. A 20-horse-power boiler carrying a pressure of not less than 100 pounds will meet the requirements. If the tank car can be placed so that a gravity flow from it can be obtained, no pump will be necessary to load the material. A pump is required in the majority of cases, however, and a duplex steam pump of a capacity of 50 to 60 gallons per minute is sufficiently large.

A tank car can be heated much more rapidly if the asphalt is kept circulating, which may be accomplished by continually pumping the asphalt from the bottom of the car around through the pipes to the top. A proper arrangement of valves and pipes will allow this to be done. Temperatures sufficiently high for properly applying the asphalt may be obtained by heating the tank cars in such a manner. It is possible to raise the temperature of the asphalt by superheating the steam, or by pumping the asphalt through a short coil of pipe laid on a coal fire, the coil being placed in the line between the pump and the delivery end to the tanks in which the asphalt is to be hauled away.

Many of the distributing trucks and tanks used on penetration jobs are equipped so as to load themselves from tank cars. This is usually accomplished by a pump on the truck, by creating a vacuum in the receiving tank, or by applying either steam or air pressure to the top of the tank car and forcing the material over. Trying to heat asphalt in a tank car with a broken or leaky coil is an expensive and vexing problem for the contractor. If the coil does not leak too badly, the material may be heated hot



GENERAL ARRANGEMENT OF PORTABLE MIXING PLANT

enough to pump from the car and then brought to the temperature at which it is to be used by some means outside of the tank car. Where the coil is in such bad shape that much foaming will occur before the material gets warm enough to pump, the coil in the car will have to be abandoned and small coils will have to be inserted in the car through the manhole.

Demurrage on tank cars counts up rapidly after the car is held beyond the free time. On penetration work, a tank can be unloaded usually in from one to two days after the material is hot, so that a tank should not be held for any length of time, if the work is properly planned and the weather is favorable for application of the asphalt. When tank car shipments are used in connection with a mixing plant, the time of unloading will be somewhat longer, possibly from four days to a week.

There is this difference between penetration work and hot mix work, however, that must be appreciated. In penetration work

where the traffic can be kept off the road, long stretches of road can be prepared in anticipation of the asphalt, and when the asphalt arrives, the road surface can be rapidly made up, and practically no lost time is involved. Serious delays will occur in hot mix work due to lack of asphalt. The mixing plant is idle and no progress at all can be made on the finished surface. To provide against such a contingency it is often advisable in hot mix work to build storage tanks that will have a capacity of one or more tank cars, so that a reserve supply of asphalt may always be had. If a storage tank is provided, the tank car can be unloaded without delay. Steel shells of a size sufficient to accommodate a tank car are expensive and are cumbersome to move and erect unless a permanent set-up is to be had.

In connection with the work of portable mixing plants, concrete tanks may be constructed below the ground level and abandoned when the job is done. Such tanks

can be constructed of the desired size and equipped with the necessary steam coils and roofed to keep out the water at a nominal cost. The asphalt is heated in the tank car and allowed to run by gravity into the concrete tank, from which it is pumped to the mixing plant as required.

Barrel and drum shipments are heated in kettles. In either penetration or hot mix work it is important to have a kettle capacity large enough for the needs of the work, in order to make proper progress and decrease the cost. For a portable kettle on penetration work, the writer would not recommend a size smaller than 500 gallons capacity, and three such kettles would be required for the usual job. Two 1,250-gallon kettles are sufficiently large to supply a 1,000-square-yard mixing plant.

If cold material is fed gradually to a kettle as it is being emptied, a new charge will be hot in much quicker time than if reloading the kettle is not started until it is practically empty. Kettles should be regularly and thoroughly cleaned, the interval of cleaning depending somewhat upon the asphalt used. Asphalt will form layers of coke on the bottom of the kettle, which not only retards the heating greatly, but also ruins the kettle bottom if not removed by allowing it to burn through.

The same general principles which apply to the economics of hauling other material apply to hauling asphalt. Some asphalt companies have developed a motor truck distributor tank to a high degree of efficiency for use in penetration work. The capacity of the largest tanks is about 1,000 gallons. These trucks work from asphalt refineries located near the large centers and haul to points sometimes fifty miles away. Such machines are manufactured for sale to the contractor by a number of companies and give excellent results in doing the work.

A motor truck distributor, however, is an expensive piece of plant, and unless a contractor is sure to have penetration work sufficient to keep it busy it is not advisable to purchase such an outfit. Certain companies make a tank with distributor attached that may be mounted on a 5-ton dump truck, the dump body being first removed. Such an outfit is better for all-round work because when not putting on asphalt the dump body can be replaced and the truck used for hauling other material. By mounting a 1,000-gallon tank equipped with steam coils on a

truck chassis, a cheap method of hauling asphalt can be obtained where the haul is long. The cost of such a tank is relatively small.

Hand distribution in penetration work, although it may give very good results if done with extreme care, is not, in the author's opinion, to be recommended. There are a number of pressure distributors on the market that do the work in a much more rapid and better manner. A low-priced machine which has been successfully used in connection with kettle heating is described as follows:

It consists of a 200-gallon drum, an air pump and tank mounted on a frame supported on a cylindrical roller. The spray nozzles are inserted into the bottom of the drum in which the asphalt is placed. When filling the drum, it is turned so that the nozzles come at the top and is kept in this position until just before distribution is started. This keeps the asphalt from cooling and plugging the nozzles. The drum is piped to the air tank and by means of an automatic valve a constant air pressure can be maintained in the drum containing the asphalt. The air pump is driven by a steam connection from the roller. The framework of the machine is attached to the draw-bar of the roller in such a manner that in distributing the asphalt the roller operator only has to concern himself with the steering of the roller, the distributor following exactly the line of travel of the roller. This machine will apply the asphalt in a very satisfactory manner, and if the capacity of the kettles is sufficient, 2,000 to 3,000 gallons a day is not too much to expect for a daily output.

A more expensive machine, but one that is well adapted for jobs on which a large quantity of asphalt is to be manipulated, is of the following type: a 500- to 600-gallon cylindrical tank is mounted on a substantial four-wheel truck having wide-tired wheels, and the front and rear wheels do not track. A fire box is constructed underneath the tank so that direct heat can circulate under and around the lower part of the tank. The spray bars are piped to and hung from the rear of the tank. An air pump is mounted on the side of the machine and piped to the top of the tank.

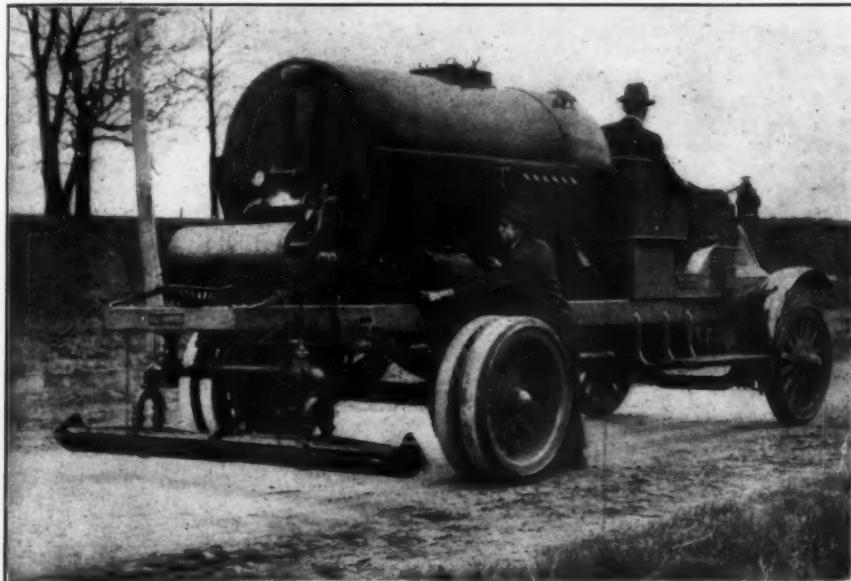
When in operation the distributor is hauled by a roller which also furnishes steam to run the air pump. By an arrangement of valves a constant air pressure can

be obtained on the asphalt in the tank when distribution is taking place. The air forces the asphalt out of the tank through the spray nozzles onto the road. The fire box is an important feature of this distributor because it furnishes a means of rapidly raising the temperature of the asphalt to any degree desired. This machine can be used in conjunction with heating the material in kettles, but a larger output may be obtained if the asphalt is taken from a tank car delivery. On short hauls the distributor may be loaded directly from the tank car, but on long hauls it is better to

distributors than by the two machines previously described, and a contractor will ordinarily use such means of distribution when it can be furnished at a cost which does not exceed too greatly the cost of some of the slower methods.

#### Mixing Plants

Mixing plants are of three distinct types, namely, stationary, portable, and railroad plants. All consist of the same units, but arranged differently, so as to adapt themselves to the purpose for which the plant is to be used. For highway construction over



A KELLY-SPRINGFIELD TRUCK EQUIPPED WITH KINNEY PRESSURE DISTRIBUTOR EITHER FOR RESURFACING ROADS OR FOR PENETRATION CONSTRUCTION

keep the distributor on the road and fill it from hauling tanks which have been loaded at the tank car. Although not ordinarily done, it is possible to spray widths up to 18 feet with one passage of this machine by making the spray bars sufficiently long.

Many of the motor truck distributors previously mentioned have a small steam boiler mounted on the truck for the purpose of heating the asphalt while in transit, and in cases where air pressure is used in distributing the asphalt the boiler furnishes the necessary steam to run the air pump. Asphalt can be applied more rapidly by motor truck

an extended area, the stationary plant is out of the question, although exceptional instances occur where the mix is hauled for very long distances. Whether a railroad plant or a portable plant is the better proposition for the contractor depends somewhat upon the kind and amount of work he may expect to do.

The railroad plant has been designed to prepare sheet asphalt mixtures. The investment in a railroad plant is large, and the loss on invested capital when the plant is idle should be appreciated. Furthermore, the added cost represented by car frame and

trucks must earn depreciation and interest during a possible use of only a few days each season. For state highway construction it will be found that the portable type is better adapted for the work because the plant can be set on or near the job, thus reducing the hauls on the ingredients used in the mix and the finished mix. All types are operated in a similar manner, and since the writer believes the portable type to be the one that will be most commonly used, he will confine his remarks to this type.

There are several makes of portable plants. The plant consists of four units, namely, the power unit, the kettle unit, the mixing unit, and the drying unit. The kettle unit is always separate, and with most makes the power unit is separate. In some the drying and mixing units are also separate. The separation of units is undertaken in order to make the plant more portable. The output of a mixing plant largely depends upon the capacity of the driers.

The most successful driers are of the rotary cylinder type, so incased by firebrick and metal as to prevent radiation of heat, and so designed that the hot gases of combustion are brought into direct contact with the mineral aggregate. Provisions for preventing the aggregate from passing through the cylinder in a mass, and for quickly removing vapor and gases, are essential. A three-unit plant having a capacity of 1,250 square yards of 2-inch top in ten hours has met all the requirements demanded of it in this kind of work in a very satisfactory manner.

In this particular plant the kettle capacity is taken care of by two 12-ton kettles. The power unit consists of a boiler and engine, or where electric current can be obtained, a 40-horse-power motor may be used. The drier and mixer are mounted on a four-wheel truck, this unit of the plant weighing about 15 tons. The drier is one of the rotary type, mounted over a large fire box in which coal or oil may be used for fuel. The sand and stone is fed to the drier by means of a bucket elevator, and after passing through the drier is carried by means of another elevator to the screens, through which it passes to proper compartments of the storage bin. From the storage bin the hot material drops by gravity into the weighing box, and from thence into a pug-mill mixer. The hot asphalt cement is forced

by compressed air through steam-jacketed pipes to the asphalt bucket on the mixing platform, where it is weighed and discharged into the mixer. The mixing platform is high enough from the ground so that the mix can be dropped through the bottom of the mixing box into wagons or trucks. A typical arrangement of the different units is shown in the illustration herewith.

While such a plant is more expensive to move and set up than some of the types which are lighter and more portable, the output obtained and the satisfaction with which the work can be done should recommend a plant of this type to the contractor who contemplates doing much hot mix work.

Roughly, in any hot mix work the asphalt comprises only about 10 per cent of the total weight of the mix. The remaining 90 per cent is mineral aggregate which will vary in its requirements, depending upon the type of pavement that is being laid. The proper location of the plant will be governed principally by a consideration of the hauls on the mineral aggregate. Suppose, for example, a paving mixture required the use of stone and sand, the proportions being about two of stone to one of sand. Assume that stone was imported by railroad, and point of delivery was one mile away from the end of a job one mile long, making average haul to job one and one-half miles. Assume that the sand supply was one-half mile from the end of the job, making average haul of sand one mile to the job, and that the sand was one and one-half miles from the railroad delivery. Where should the plant be located from the standpoint of most economical haul? The amounts of materials making up the mix would be stone 60 per cent, sand 30 per cent, and asphalt 10 per cent, or 70 per cent of the material required for the mix would be delivered at the railroad. For purposes of comparison, assume that twenty-five cents a ton-mile would be the cost of hauling either of the raw materials, or the finished mix. The following tables show how the cost of hauling per ton might work out:

PLANT SET AT RAILROAD	
Cost of hauling asphalt and stone to plant....	0
Cost of hauling sand to plant 1½ miles, 30 per cent in a ton .....	11.25
Cost of hauling mix to road 1½ miles.....	37.5
Total per ton, cents .....	48.75

## PLANT SET IN SAND PIT

Cost of hauling asphalt and stone to plant, 1½ miles, 70 per cent in a ton.....	26.25
Cost of hauling sand to plant.....	0
Cost of hauling mix to road 1 mile.....	25.0

Total per ton, cents ..... 51.25

## PLANT SET AT END OF ROAD

Cost of hauling asphalt and stone to plant, 1 mile, 70 per cent in a ton.....	17.5
Cost of hauling sand to plant ½ mile, 80 per cent in a ton .....	3.75
Cost of hauling mix to road ½ mile.....	12.5

Total per ton, cents ..... 33.75

In preparing pavement mixtures where two or more materials are used to procure the required grading of the mineral aggregate, engineers will frequently require measuring boxes to be used in delivering the different ingredients to the machine, so as to insure the right proportions being maintained. The writer has in many instances prepared a mix which will test out correctly, even where three or four different materials are used, by the following method. This method has been used in connection

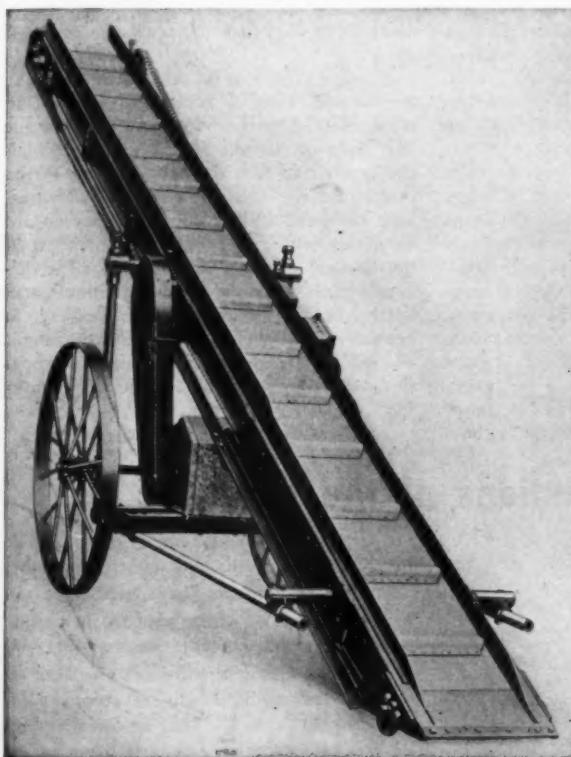
with the portable plant previously described, where the mineral aggregate is carried to the drier by means of a bucket elevator.

It is first necessary to determine the proportions by which the different materials are to be used. A batch of the materials of these proportions is carefully mixed and placed around the foot of the bucket elevator so as to form a crater. The stock-piles of the different materials are placed as near the elevator as possible, and one or more men are placed at each stock-pile. When the plant is operating, these men are trained to shovel from the different piles in a certain definite manner according to the proportions of the different materials required. Men on one pile may take a heaping shovelful, and on another the men may use only a level shovelful, while one man is taking a shovelful from a third pile. The men throw material from the different piles into the crater of carefully mixed material at the foot of the elevator. The use of different size shovels is advisable in some cases.

A contractor doing hot mix work should understand how to make tests of the mix. He should supply himself with a set of testing sieves and make frequent tests of the output for the purpose of controlling the proportions to be used.

## Crushing Equipment

Experience has shown the 9½-inch or 9¾-inch jaw crusher to be a size and type suitable for highway work. A crushing plant consists of three units—the crusher and elevator, the bin, and the power unit. A 50-ton portable bin is generally of ample capacity to meet the requirements. Portable bins of this type are made in two styles, one which is a knockdown bin, and one which is mounted on a four-wheel truck, so arranged that it can be



A PORTABLE SCOOP CONVEYOR FOR LOADING TRUCKS



A NO. 4 CHAMPION ROCK CRUSHER OUTFIT IN USE IN DEKALB COUNTY, PA.

shipped on railroad cars complete without exceeding the headroom clearances required by the railroads. The assembled bin can be put into operation more quickly than the knockdown bin. Both types of bins are usually provided with a side delivery.

When a crushing plant is set up in a ledge or gravel pit, advantage can be taken of some special means of getting the stone to the crusher, such as a steam shovel and industrial cars, hoisting engines and skips, or other mechanical devices which considerably reduce the cost of the operation. Where a local stone supply comes from stone walls, or field stone, delivery to the crusher is usually accomplished by teams. Advantage can in some instances be taken of the topography so as to make a haul

away from the crusher largely one of down grade.

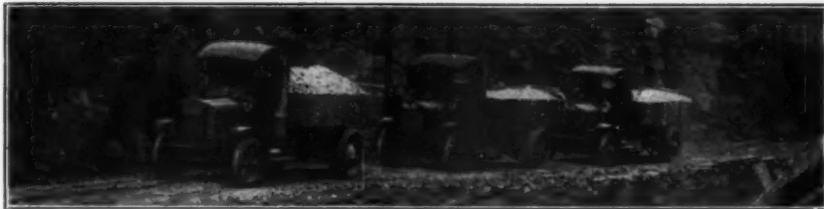
A proper selection of screens of the right length and size of holes will enable the contractor to meet almost any requirement for sizes of stone. The speed at which the crusher is run, the jaw opening at the bottom of the crusher, the kind of stone, and the speed and length of the screen are variables which not only affect the total output, but also the proportions of the different sizes of stone. In bituminous road work, careful planning is necessary in crusher operation, so that the proper amount of special sizes can be obtained without the necessity of a great amount of recrushing.

*(Concluded in June issue)*

## The Functions of the Engineer

THE engineer in responsible charge of construction work which is being done by a contractor, an individual or a firm, at once exercises two functions, one requiring engineering knowledge, skill and experience, the other, judicial fitness. He becomes the arbiter between the principal, man, firm or corporation for whom the work is being done and whose money is paying for it, and the contractor who is doing the work. He must be a just judge, executing righteous judgment between the parties to

the contract, without fear or favor. The fact that his client, the principal or first party to the contract, pays him, must not have the value of a pennyweight in tipping the scale in favor of the source of his income. The engineer owes his client an allegiance demanding intelligent, conscientious and diligent service. That he owes, but his debt demands for its liquidation no act, no word, which would compromise his integrity or offend his sense of what is just right.



## The Transportation Requirements of the Contractor

### Analysis of the Use of Motor Trucks and Other Mechanical Means for Helping the Contractor

**A**S a general rule, unless a job is handled on a cost plus basis, the contractor gets the work to do by a lump-sum bid. This is the first of a long string of hazards in his business. If his price is right, all the higher bidders figured incorrectly. If the others were right or nearly right, the successful bidder may be wrong. After the work is under way, he may meet with a thousand and one delays: the weather may be unfavorable; he may have difficulty getting enough men or the right type of men; supplies may be slow coming in or, when they do, they may not be up to the specified standard; and there are many other causes of costly delays. These are particularly exasperating when the contractor works against time and a financial penalty.

Transportation is the keynote of a contractor's success. The job must be kept moving, material must be transported to the base of supplies in a steady stream, by rail, by boat or by truck. It must move from the base to the job without a break to keep men and machines going at the best working speed. It must have the right kind of superintendent to keep the men, trucks and horses and machines moving, and, last but not least, he

must have men, horses and machines that will stand up to the job day after day under terrific wear and tear.

The movement of material and equipment from the base of supplies or from the several bases of supplies or yards, of material supply men to the machines on the job, and from them to the point where actual construction is in progress, is the transportation usually under the eye of the contractor. Motor trucks, horses and dump cars on narrow-gage tracks, and industrial railways with gasoline locomotive, are the usual methods of transportation.



**A CHAIN FALLS SLUNG IN THIS MANNER SAVES VALUABLE SPACE**

Each year motor trucks play a larger part in the transportation systems peculiar to the contracting business. The truck is displacing the horse because it will do more work in less time at less cost per unit mile. Here and there contractors are using the truck instead of the narrow-gage railway because of the mobility of the truck and its adaptability to other uses. There are many questions which arise in the contractor's mind regarding the use of motor trucks in his work. Among the questions are the following, with their answers given briefly:

**Are Trucks More Efficient Than Horses?**

There is ample evidence to show that the truck can haul or pull more than the horse, because it does not tire as does the



QUICK LOADING SAVES THOUSANDS OF DOLLARS IN A YEAR

horse, is far more powerful, and can handle loads in larger units.

**Should the Contractor Buy or Rent Trucks?**

Trucks and other contracting equipment cost money when idle. This brings up the point of the contractor's location geographically. Those in the northern part of the country face a long winter. Those in the south have a longer busy season and less loss of time in the winter. The ability of the contractor to keep his equipment busy all winter has often decided the question of buying or renting trucks. Another factor that contractors take into consideration is the question of investment. It may take all the way from 1 to 100 trucks to get away with a job. Some contractors hold one or more trucks in reserve for emergencies. At times the entire fleet is idle because of weather or other conditions. Trucks cost money, and the contractor often decides that he will rent instead of operating his own.

Contractors who operate their own and rented trucks have felt that no matter whether you buy or rent, you must figure on making money from them. The price to be paid as rental should be definitely fixed and thoroughly



MODERN EQUIPMENT SAVES THE WORK OF SCORES OF MEN AND HORSES

understood by both parties. Whatever the price may be, the contractor must make a profit on it. He must use a truck that will stand up. A contracting job is no place for a weak-kneed man, a broken-down horse or an inefficient truck. Many a truck has been forced to quit a job because it lacked power to haul big loads over rough roads. If a contractor rents trucks he wants to do business with a reliable concern that can rush an emergency truck or two to the job when needed. If the contractor intends to purchase, he should carefully study the large number of trucks offered, to determine which meets his condition most satisfactorily.

**How Much Does It Cost to Operate a Truck?**

Actual cost data on different capacities of trucks are most accurately secured through the use of the National Standard Truck Cost System, and accurate data may be secured from any manufacturer regarding the use of his truck by contractors. Estimated costs, after all, are merely estimates, and valuable only when a company is honest enough to include all the elements which go to make up costs. There are estimated costs being advertised that make it appear possible to operate a 5-ton truck for



**A BLOCK BACK OF THE REAR WHEEL TAKES THE LOAD OFF THE BRAKES**

a very small sum. A close analysis of such figures by a contractor may show that the truck was operated under unusually favorable conditions or that some important element such as depreciation was entirely omitted.

Costs per day mean nothing. A 2-ton truck running, say, 50 miles a day, and carrying capacity loads, may cost more per day than a 6-ton truck that spends part of its time in the garage. A 4-ton truck operated under certain conditions also will cost more than a 6-ton truck operated under certain other conditions. The same truck may cost \$25 to operate one day and \$20 the next. The same capacity truck operated on the same job under identical conditions often shows considerable variation in costs. The ability of the driver, the care given the truck, the overloads, the underloads it is called on to carry, and many other things, determine costs. The very best method of pinning down costs is the National Standard Truck Cost System. This is the only way to get accurate and comparable costs on the unit mile basis, the ton-mile, the thousand-foot mile or whatever unit may be selected. Hit-or-miss methods do not give dependable data for comparison.



**THE HYDRAULIC HOIST IS OPERATED BY THE TRUCK DRIVER**



A POWERFUL CRANE OFTEN IS NECESSARY IN THE CONTRACTOR'S WORK

#### Do Trucks Pay on Short- as Well as on Long-Haul Work?

Contractors have proved that trucks will pay big returns on short- as well as on long-haul work. Usually the only requirement is careful planning of the work to be done, the employment of competent drivers, the installation of quick loading and unloading devices.

#### Can Trucks Be Used for Work Other Than Hauling?

Every day contractors are using trucks to haul trailers, to pull rocks out of excavations or proposed road-beds, to pull down trees, to move houses, to pull freight cars and barges alongside docks. In road building trucks are used to pull road grading machinery, levelers, hones, drags and scarifiers. Contractors in some of our larger cities have equipped their trucks with snow-plows, and take on the work of snow removal during winter storms. This is an advantageous side line, as when traffic is held up with snow the contractor cannot well operate his truck economically.

In cases of emergency, trucks have been used to run dynamos, mixing plants or other machinery by jacking up one of the rear wheels and slipping a belt over it.

#### Is Additional Equipment Necessary to Make Trucks Pay?

Whether trucks are owned or rented, they must be made to return a profit to the contractor. The only method of knowing this is by the installation of a cost system

on the entire job and close scrutiny of the work accomplished by a truck. Lost time is the bottomless pit into which more money has been dumped by contractors than can be estimated. A motor truck cannot be operated at highest efficiency unless supplemented by auxiliary equipment. This is especially true when the truck hauls loose materials. The most successful contractors are those who operate trucks in conjunction with an adequate plant. The plant must be big enough and must be complete. Rapid loading and unloading devices are especially essential to profitable motor truck

transportation. The steam shovel, removable sheet steel bodies, power cranes, bucket conveyors, loaders for bag cement, side- and end-dump bodies, overhead loading bins of large capacity, an adequate supply and storage of water, tank bodies for hauling water, oil and hot asphalt, trailers of different types for carrying different kinds of materials—some or all of these are necessary not only to make the truck pay, but also to make the job pay.

All of the foregoing material is not always necessary. In many cases only a part is needed, and careful study of each job before it is bid on, and after the contract has been awarded, will enable the contractor to pick the proper auxiliary loading, hauling and unloading devices and will enable him to choose the proper number so that he will not be either under- or overstocked.

#### How Can a Contractor Choose a Dependable Driver?

The contractor's truck driver should be the very best he can get. Any truck is only as efficient as its driver. Dependable drivers can often be obtained through dependable truck distributors. The driver should be one who takes a real interest in his work and who will go over his truck every night after work. A driver who has attended some reliable motor-truck school and who knows the importance of lubrication and proper care, who drives his truck with proper regard for its value as a costly machine, who knows the destructiveness of overloading,

has in him the basis of what a contractor needs for a driver.

#### How to Choose the Right Capacity Truck

The capacity of a truck depends on the job, and no two jobs are alike. The determination of the proper capacity, however, is a vital matter. A wrong decision means increased expenses or lost profit. An analysis of the work to be done and all the conditions under which the truck is to operate should be made by the contractor, if possible in conjunction with an experienced transportation engineer.

#### What Special Equipment Is Needed on the Truck?

Every contractor is familiar with special truck equipment, such as hydraulic hoists, cranes, winches, towing-hooks, special tail-boards, tanks, etc. The examination of the equipment of other contractors, a close scrutiny of the catalogs of reputable manufacturers, will enable the contractor to choose the proper special equipment for his

truck for his special lines of work.

#### Winter Uses of Trucks to Keep Down Overhead

The growing necessity of keeping roads open in winter is giving employment to many trucks in dragging snow-plows or operating pusher-plows. In many cases the snow is piled up on the side of the street and hauled by motor trucks to a specified dump. Some contractors rent their trucks out to harvester of natural ice, others work for coal firms and even department stores at rush seasons.

Removing cinders from manufacturing plants keeps more and more trucks busy, especially in cities and towns where cinders are used for street improvement. Firms owning trucks that are rented on a day basis often have need for an extra truck or two. Many large cities and chambers of commerce now have truck bureaus that find work for trucks.

ACKNOWLEDGMENT.—Illustrations courtesy the Packard Motor Car Company, Detroit, Mich., and the White Company, Cleveland, Ohio.

## Giant Road Leveler for Use with Heavy-Duty Tractors

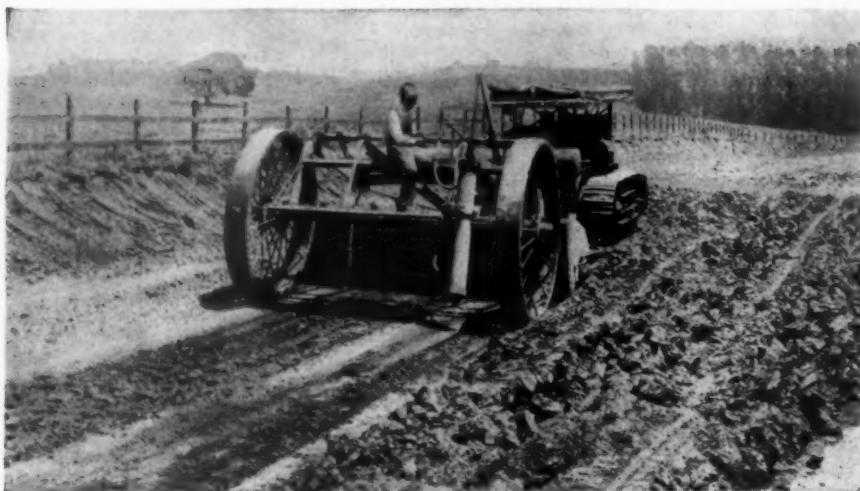
**A**LARGE leveler, known as the "Schmeiser Giant Leveler," has been developed by the Schmeiser Manufacturing Company, Davis, Calif., for use on large road jobs or for leveling large tracts of land. This leveler, as shown in the illustration, has a capacity of 4.35 cubic yards of earth, which is equal to the combined capacities of 9 fresnos. From the fact that 9 fresnos require the services of 9 men and 36 horses, while this leveler needs but 2 men and a tractor, the ability of this machine to economically and quickly handle large quantities of work will be appreciated.

The specifications of the large-size leveler, which requires a 75-horse-power tractor, are as follows: frame made of 5-inch, 9-pound channels, well braced and riveted with  $\frac{3}{8}$ -inch boiler rivets, axle of 3-inch steel with spindles turned down to  $2\frac{1}{2}$  inches; rocker shaft of  $2\frac{3}{4}$ -inch cold-rolled steel; wheels 4 feet high with 10-inch treads; pull bars of 4-inch channels; buckets of  $\frac{3}{4}$ -inch universal steel plates, 12 feet wide, and 3 feet high, with 4-foot sides and plow steel blade. The bucket has a center draw-bar to take up strain on center of bucket. Machine is operated by compressed air and weighs 5,300 pounds.

The illustration, page 60, shows the Schmeiser road leveler at work in Sonoma County, Calif., where a bond issue of \$1,640,000 is being spent in road building, under the direction of Lloyd Aldrich, County Engineer. With regard to the

work of this machine, Mr. Aldrich said, "The 8-foot leveler takes the place of about 4 teams. Being operated by only two men, it effects a saving not only in the expense of moving earth, but also in men, a very important factor because of the great difficulty of securing skinners and teams. I originally tried out these levelers on road work on the U. S. Farm Lands Company property at Chowchilla, Calif. At that time I used an 11-foot leveler, 75-horse-power tractor and secured fine results where there was ample room. On the Valley Ford highway work, where the right of way is confined to a width of 60 feet, a 45-horse-power Holt Caterpillar tractor and an 8-foot Schmeiser leveler make up just the right equipment."

A unique feature of the Schmeiser road leveler is the mechanism for scraping, filling and dumping by compressed air. This is accomplished by a compressor, air receiver and air hoist, the compressed air being piped back to the receiver on the leveler. A comfortable seat is provided on the leveler for the operator. Or, if desired, the tractor driver can operate the leveler himself. The air compressor is mounted on the tractor, where it is driven with a belt connection to the stationary attachment of the tractor or to the crank shaft. The leveler may be attached to the tractor direct, but where it is necessary to make short turns, as in road building, a low-wheel, heavy pony



A GIANT ROAD LEVELER BEING HAULED BY HOLT TRACTOR

truck is furnished which enables the leveler to turn around in a space of 20 to 30 feet. The 60-horse-power Tracklayer tractors, manufactured by the C. L. Best Tractor Company, San Leandro, Calif., use a special air compressor requiring no belts, the compressor being built into the tractor from the main crank shaft, direct-connected.

In road work, the Schmeiser leveler is preceded by a scarifier that loosens the soil. This leveler, aside from its capacity and economy of operating, has the advantage of dumping its load and leveling the surface in one operation, thus not obstructing traffic on a road that is being regraded. It also pulverizes the soil and settles the fill by spreading a light layer.

## The Public and Professional Obligations of the Engineer

**T**O the public at large the engineer owes good citizenship. With every other citizen he shares responsibilities for government, civic, state and national, and his efforts should be to make government good. He cannot hold himself aloof from those activities which our form of government imposes upon those who live under it, and escape responsibility for its short-comings and its failures. If an unworthy man represents him in any governing body, he shares that unworthiness unless he exercises the right and duty of good citizenship and tries to put a good man into the office that the weak or bad man holds. "They also serve who only stand and wait" may be true of those who, through misfortune, are cut off from life's activities, but the saying does not apply to any live engineer. "He must be up and doing." He must keep his

mental equipment as fit for service as the soldier keeps his arms, and the guiding motives of his life true, lest they fail him when the hour of trial comes.

Moreover, an engineer owes his professional obligation to the public by reason of his special training along technical lines. Therefore he should use his knowledge and experience to promote the general welfare by every means in his power. He stands upon the watchtower of progress to warn against danger and to show the way to better methods in dealing with problems of engineering. He should stand against the individual or group of individuals who try to exploit, for their own profit or advantage, forces of nature which belong to the nation, the state or the municipality, without making a just return therefor to the rightful owners of the potentiality.



# EVERY CATALOG

The catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up to date on the subject of machinery and equipment.

# SPECIALLY SELECTED

#### LIGHT-WEIGHT CONCRETE MIXERS

Catalog D 6, recently issued by the Koehring Co., Milwaukee, Wis., tells all about the Dandie Koehring-built light-weight mixer for concrete work.

#### STEAM SHOVELS THAT FILL THE BILL

Bulletin C-G, which may be secured gratis from the Bucyrus Co., Milwaukee, Wis., tells all about the speed, ruggedness and power of Bucyrus shovels for crane work, sewer excavation and drag-line work.

#### EXCAVATOR CRANES

The work of P. & H. excavator cranes in use 24 hours a day on excavation and drainage ditches, as well as on highway work, is described in literature which may be secured from the Excavating Machinery Division, Pawling and Harnischfeger Co., Milwaukee, Wis.

#### BRASS WELL SCREENS

In driving and preparing deep wells you want to be sure of the capacity of your well screens. Full information regarding them may be secured from Edward E. Johnson, Inc., St. Paul, Minn.

#### LOCOMOTIVES FOR EVERY PURPOSE

There is a Porter locomotive in every size and type which gives continuous work and service for all kinds of contracting work. These are listed in full in the catalog of the H. K. Porter Co., Pittsburgh, Pa.

#### SPREAD YOUR STONE BY MOTOR TRUCK

Department K 5, Burch Plow Works Co., Crestline, Ohio, will be glad to send complete descriptions of the Burch stone spreader, which will eliminate hand spreading and extra labor for any contractor or engineer who contemplates any road-surfacing jobs.

#### STREET AND PARK LIGHTING

The latest catalog of the George Cutter Works, Westinghouse Electric and Mfg. Co., South Bend, Ind., describes in detail the value of Cutter street and park lighting equipment, including ornamental posts and tops.

#### ECONOMICAL ROAD BUILDING

The complete literature of the Austin-Western Road Machinery Co., Chicago, Ill., regarding the right way to grade roads and the proper kinds of machinery for the work, is yours for the asking. Selection of the right machine is the first step in the proper economy of road building.

#### ECONOMY IN C. I. PIPE LINES

Full information regarding the use of Universal cast iron pipe, which may be laid with remarkable rapidity and economy and which requires no calking, packing nor gaskets, may be secured from the Central Foundry Co., 90 West St., New York City.

#### BUILDING CONTRACTORS' HOISTS

This is the title of a loose-leaf bulletin published by the Patten Manufacturing Co., Chattanooga, Tenn., which contains bulletins giving detailed information regarding the various types of single- and double-drum electric and gasoline-driven hoists with single and variable speeds.

#### PNEUMATIC TOOLS AND DRILLS

In catalog No. 11 C, the Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill., describes in detail its line of Thor pneumatic tools, including pneumatic drills, piston air drills, turbine air drills, close-quarter piston air drills.

#### MAKING ROAD JOBS PAY

Full information regarding the use of the Cletrac, a tractor weighing 3,455 pounds and having a draw-bar pull of 12 horse-power for road work, is described in detail in the road-building literature of the Cleveland Tractor Co., 1921 Euclid Ave., Cleveland, Ohio.

#### WATERPROOFING COMPOUNDS FOR CEMENT

Full details regarding the use of "Toxement" and integral waterproofing compound for Portland cement may be secured from Tech Bros., 320 Fifth Ave., New York City.

#### DEPENDABLE DIESEL ENGINES

Full information regarding the efficiency, economy and dependability of American Diesel engines may be secured from the Busch-Sulzer Bros.-Diesel Engine Co., St. Louis, Mo.

#### DUMP-WAGONS AND MOTOR TRUCKS

The Tiffin Wagon Co., Tiffin, Ohio, will be glad to send its bulletins describing its motor trucks and dump-wagons to any contractors interested in increasing the efficiency of their equipment.

#### WATER METERS FOR ALL SERVICES

The latest literature of the Hersey Mfg. Co., South Boston, Mass., contains complete data regarding the dependability, usefulness and accuracy of the different types of Hersey meters for all kinds of water services.

#### DON'T WAIT FOR AN EPIDEMIC.

Any engineer or citizen who has doubts regarding the bacteriological purity of his local water-supply should act at once to have it chlorinated. Don't wait for an epidemic, but write to Wallace and Tiernan, Inc., Box 178, Newark, N. J., and ask for their latest literature regarding the use of chlorinators for town water-supplies.

#### FILING CASES FOR CONTRACTORS' PLANS

Sectional filing cases and special cases for engineers' and contractors' plans, maps, tracings, and blue-prints are described in catalog 10, which

may be secured from the Economy Drawing Table & Mfg. Co., Adrian, Mich.

#### TAR KETTLES AND SAND DRYERS

Catalog No. 17, containing descriptions and illustrations of various types of tar kettles and sand dryers for highway and road work, can be secured by writing to the Joe Honhorst Co., 1016-20 West 6th St., Cincinnati, Ohio.

#### DURABLE ROOF PAINTS

Contractors interested in securing data on dependable roof paints that last and are easy to apply, should secure a copy of the booklet entitled, "Paint for Roofs," from the Joseph Dixon Crucible Co., Jersey City, N. J.

#### ROAD-MAKING MACHINERY

In an illustrated folder entitled "A Hard Road Makes an Easy Road," the Good Roads Machinery Co., Inc., 321 Bulletin Bldg., Philadelphia, Pa., describes in detail its complete line of road-building machinery for contractors.

#### REBUILT MACHINERY FOR CONTRACTORS

A very real saving on equipment for all kinds of construction work may result from consulting the used equipment lists of Foraythe Bros., Hudson Terminal Bldg., New York City, before buying.

**HAMMERS AND HOISTING ENGINES**

The new catalog of the National Hoisting Engine Co., Harrison, N. J., describe in detail National hammers operated by steam or air, which deliver 150 to 400 blows per minute, also steam, gasoline and electrically-driven hoisting engines in all sizes.

**WOVEN WIRE AND VIBRATING SCREENS FOR STONE AND GRAVEL**

Catalog 43 M, which may be secured from Frank Wulf, W. S. Tyler Co., Superior Ave. and East 36th St., Cleveland, Ohio, contains complete information regarding the use of woven wire screens and inclined vibrating screens for properly sizing gravel and crushed stone for road work.

**EXPLOSIVES FOR CONTRACTORS**

Complete information regarding different types of explosives, with prices, may be secured by writing to E. I. Du Pont de Nemours & Co., Inc., Sales Dept., Explosives Division, Wilmington, Del.

**GEAR-DRIVE LOCOMOTIVES FOR CONTRACTORS**

The Davenport Locomotive Works, Davenport, Ohio, build all types of locomotives, including gear-drive machines which are specially adapted for use on light rails, steep grades, sharp curves, rough track and for industrial switching. Literature describing these locomotives may be secured on request.

**DUMP TRUCK BODIES AND HOISTS**

The features of Archer hand hoists and dumping motor truck bodies are described in the printed literature of the Archer Iron Works, Chicago, Ill.

**SHIELDS FACILITATE EXCAVATION**

A book describing Austin trench shields, which greatly aid the speedy shoring of trenches, may be secured from the Austin Machinery Corp., 609 Rail-way Exchange Bldg., Chicago, Ill.

**PORTABLE ASPHALT MIXING PLANT**

Bulletin 2A, issued by the Iroquois Sales Dept., Barber Asphalt Paving Co., Philadelphia, Pa., contains complete information regarding the operation of Iroquois portable asphalt mixing plants, the product of 40 years' experience.

**COMBINATION AIR COMPRESSORS**

Full information regarding portable pneumatic compressor outfits for road and general contracting work will be found in Bulletin F.C. 1, issued by the Rix Compressed Air and Drill Co., 505 Howard St., San Francisco, Calif.

**SIZE, WEIGHT AND STRENGTH OF ROPE**

The Whitlock Cordage Co., 46 South St., New York City, has prepared a schedule of sizes, weight, strength and length of rope which is valuable in determining the sizes needed for contractors' work. These "Rope Schedules" may be secured on request.

**MAKE YOUR OWN BLUE-PRINTS**

The blue-print machine described in detail in the booklet issued by Wickes Bros., 370 Water St., Saginaw, Mich., will make continuous prints up to 48 inches in width and of unlimited length.

**METER BOXES AND METER TESTERS**

Catalogue R, issued by H. W. Clark Co., 130 South 17th St., Mattoon, Ill., tells the complete story of the Clark meter tester, valve housing, leak indicators and other water-works appliances, and will be sent to all interested parties.

**SIPHONS FOR SEWAGE SYSTEMS**

The Pacific Flush Tank Co., 4142 East Ravenswood Ave., Chicago, Ill., will be glad to send its literature regarding siphons for different services in connection with sewage systems.

**BULLETIN OF USED MACHINERY**

The Walter A. Zelnicker Supply Co., St. Louis, Mo., will be glad to send a copy of Bulletin 290, containing listings of road rollers, portable track rails, locomotives, dump-cars, boilers, engines, steam shovels, steel piling, tanks, pipe and crushers for sale.

**KNOW HOW MUCH WATER IS PUMPED**

The type M register and Venturi meters manufactured by the Builders Iron Foundry, Providence, R. I., and described in its illustrated literature, are of interest to engineers and contractors who must furnish metering equipment for gravity mains, filtration plants, discharge lines, etc.

**INEXPENSIVE ONE-YARD DUMP BODIES**

The new Heil patented gravity body, designed for use in building concrete roads, is described in literature which will be sent you on request by the Heil Co., 1243 26th Ave., Milwaukee, Wis.

**COMPLETE CONTRACTING EQUIPMENT**

Catalog No. 69, issued by the Standard Scale & Supply Co., 1631 Liberty Ave., Pittsburgh, Pa., contains complete data regarding the Standard line of contractors' equipment, including concrete mixers, street pavers, hoists, pumps and engines.

**STEAM AND OIL ENGINES**

The Nordberg Mfg. Co., Milwaukee, Wis., will be glad to furnish information regarding steam engines, oil engines, mine hoists, air compressors, blowing engines and condensers, to engineers and contractors tackling problems in these fields.

**A NEW CONCRETE MIXER CATALOG**

The T. L. Smith Co., 1120 32d St., Milwaukee, Wis., has just issued a 48-page catalog, No. 405 AL, describing in detail the Smith non-tilting mixers for paving and road work.

**ATTRACTIVE OFFERING OF USED EQUIPMENT**

Marvin Briggs, Inc., 167 Sixth St., Brooklyn, N. Y., is at the service of contractors, with a complete line of second-hand machinery described in a circular which is obtainable on request.

**ROAD AND STREET CONSTRUCTION**

The Executive Offices of Warren Bros. Co., Boston, Mass., will be glad to forward to any contractors details of Warrenite-Bitithile pavement construction.

**ASPHALT SURFACE HEATERS**

The Hanck Mfg. Co., 10th St., Brooklyn, N. Y., has issued Bulletin No. 113, describing its line of asphalt surface heaters for repairing sheet asphalt and bituminous concrete pavements.

**A NEW CENTRIFUGAL PUMP CATALOG**

The De Laval Steam Turbine Co., Trenton, N. J., will be glad to send a copy of its new centrifugal pump catalog, B 96, to all interested engineers and contractors who have pumping problems large and small.

**FREE CONCRETE CONSTRUCTION HANDBOOK**

For contractors east of the Mississippi, the Alpha Portland Cement Co., Easton, Pa., has issued a 98-page concrete construction handbook which is illustrated and contains valuable information and data for contractors for bidding and for actual construction work.

**ASPHALT PAVEMENT REPAIRS**

The Lutts surface heater, manufactured by the Equitable Asphalt Maintenance Co., 1901 Campbell St., Kansas City, Mo., which softens asphalt and other bituminous pavements and vulcanizes old and new material into a perfect bond, is described in detail in the literature of this company, which may be secured free on request.

**PAVING MIXERS**

The Jaeger Machine Co., 215 Dublin Ave., Columbus, O., will be glad to send to progressive contractors copies of its booklet describing the Jaeger concrete mixer for paving and sidewalk work.

**ASPHALT WITH ANY DESIRED CHARACTERISTIC**

Contractors interested in securing an asphalt which can be furnished with any melting point, any ductility and any penetration, should write to the Pioneer Asphalt Co., Lawrenceville, Ill., and ask for a copy of its booklet describing Pioneer Ruberoid cement.

**PORTABLE UNLOADER AND STORAGE BINS**

The Fairfield Engineering Co., Lancaster, O., has just issued a new pamphlet describing its portable car unloader and storage bin, which is made in 30-ton units. This pamphlet will be sent free to contractors and engineers on request.

**EXPANSION JOINTS FOR ROADS**

Many a contractor has been puzzled over what to use for expansion joints for concrete, brick, wood block and stone paving. The literature of the Waring-Underwood Co., Fernwood, Pa., describing the Ideal expansion joint, will prove of interest and benefit.

**DRILLING MACHINES**

In catalog CM 145, published by the American Well Works, Aurora, Ill., contractors will find valuable data regarding drilling machines for wells, deep blast hole work and prospecting, as well as a complete list of all types of drilling tools.

**EARTH-MOVING MACHINERY AND TOOLS**

General Catalog No. 81, just issued by the Baker Manufacturing Co., 503 Stamford Ave., Springfield, Ill., contains illustrated descriptions of all types of earth-moving machinery for contractors.

## CONTRACTORS', ENGINEERS' AND MANUFACTURERS' NOTES

### Tracy with Hicks-Parrett Tractor

J. E. Tracy, for the past four years General Sales Manager of the Sterling Motor Truck Company, Milwaukee, Wis., on April 1 became actively connected with the Hicks-Parrett Tractor Company, Chicago Heights, Ill., as Vice-President and Director of Sales. For ten years Mr. Tracy was in charge of the sales of the Milwaukee Corrugating Company, large manufacturers of sheet metal building products. He was chosen by the Sterling Motor Truck Company, Milwaukee, Wis., to take charge of the United States, Canadian and foreign business, which post he has occupied for the past four years.

### Western Pitometer Office

The Pitometer Company, 52 Church Street, New York City, has announced the opening of a Western office in charge of A. E. Skinner, Western Manager, at Room 1402 Monadnock Block, Chicago, Ill.

### President of H. K. Porter Company Dies

H. Kirke Porter, President of the H. K. Porter Company, Pittsburgh, Pa., and known as one of the pioneer builders of locomotives in the contracting field, died at his home in Washington, D. C., early in April.

### Convention of Asphalt Association

The second annual convention of The Asphalt Association, held at the Association headquarters in New York, April 13, marked important general advances in the road-building and street-paving field. The Association, which is the national organization of asphalt producers, machinery manufacturers and contractors, took the lead in advocating measures which, if adopted, will go far toward placing the road-building and street-paving industry on a higher plane and a sounder footing, and will not only create more wholesome competition, but eliminate waste and extravagance in highway construction.

The annual address of the President, Joseph R. Draney, of the United States Asphalt Refining Company, New York, showed the need of many men for work during the highway construction period now opening. Mr. Draney reported that the asphalt industry, on the whole and despite present conditions, is in a sound condition, with prospects for the production of enough oil to assure an adequate supply of asphalt for years to come.

### New Offices for Austin-Western

The Austin-Western Road Machinery Company has recently moved its offices to the new Wrigley Building, 400 North Michigan Boule-

vard, Chicago, Ill., where it has much larger and more commodious quarters than at its old location at 910 South Michigan Avenue.

### A Materials Handling Meeting

The new Materials Handling Division of the American Society of Mechanical Engineers is planning sessions for the discussion of "Design and Construction of Machinery for Road Building" at the Society's spring meeting to be held at the Congress Hotel, Chicago, May 23-26.

### New Southern Office of the Brown Company

The Brown Hoisting Machinery Company, of Cleveland, Ohio, has announced the opening of a Southern office in the Whitney-Central Building, New Orleans, La. The states of Texas, Louisiana, Mississippi, Alabama, Georgia and Florida will be covered from this office. Charles H. White, manager of the new office, has been with the company for a number of years, and is an experienced sales engineer on all types of Brownhoist products. Among these are locomotive cranes, buckets, electric hoists, trolleys, etc.

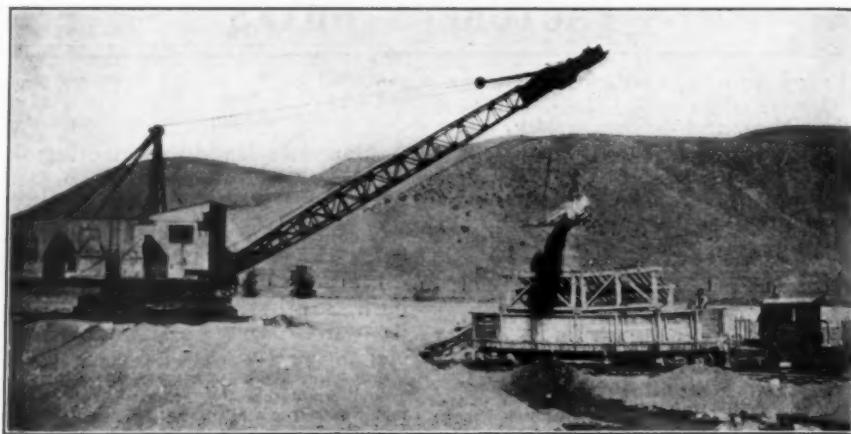
### Information Bureau for New York Contractors

In order to supply complete information to contractors for all New York State departments, the American Surety Company of New York has opened a State Surety Bond Bureau at 148 State Street, Albany. The service of this Bureau will be to furnish without cost to its clients accurate contract news from every department as soon as the information is made available to the public.

The State Surety Bond Bureau will be under the direction of Farrington Smith, who has had long experience in the insurance and surety field. The work will be comprehensive, covering not only construction work, but also supplies of every kind. Some of the services of the Bureau will be: daily bulletins containing notices of all state calls for bids on purchases, sales and construction work; the furnishing of bidding blanks and specifications to all contractors interested; telegraphic notice of bid openings and awards; filing of bid papers; reporting of bid openings, with prices.

While a few of the state departments have for periods sent calls for bids to contractors, there has been no way of getting information from all departments except at considerable expense in keeping a representative in Albany. The State Surety Bond Bureau will in effect act as Albany representative for its client contractors, serving them in every possible way. The office of the Bureau will be distinct from the Albany Branch of the American Surety Company, which solicits and executes surety bonds of all kinds.

## Contractors' Machinery and Trucks



AN ELECTRIC DRAG-LINE EXCAVATOR WITH GRIZZLY CAR USED TO CARRY GRAVEL TO PLANT, ALSO GENERAL ELECTRIC 15-TON ELECTRIC LOCOMOTIVE FOR HAULING



AN OSGOOD SHOVEL WITH CLAM-SHELL BUCKET AND TRACTION TREAD, LOADING AN ACME TRUCK



A GMC TRUCK HAULING BUILDING EXCAVATION UP A STEEP INCLINE



A NEW DEVELOPMENT IN DUMP BODIES FOR MOTOR TRUCKS

The Federal Motor Truck Company has developed this high-lift body for handling gravel and other materials which must be transferred from a truck at ground level to a gondola car or a truck with high sides. The picture tells the story

## Beverly Adds to Penetration Roads System

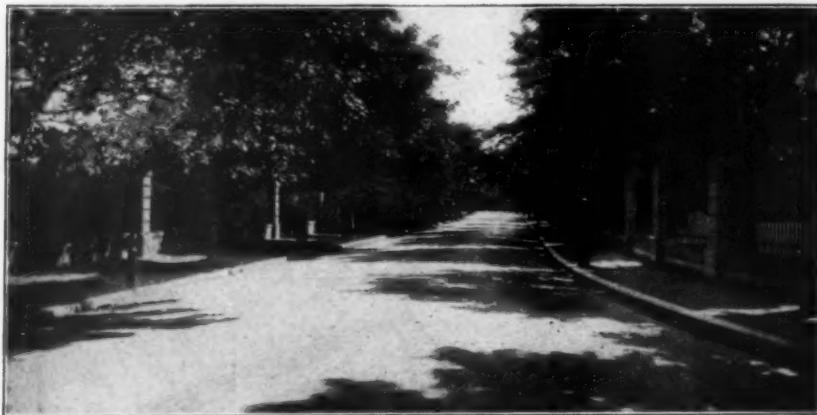
New England City Appreciates Value of Less Expensive Type of Road Construction

WITH a reputation for superb highways gained by the asphalt penetration macadam roads constructed since 1912, Beverly, Mass., one of the towns along the famous North Shore, this year is adding to the mileage of modern, heavy traffic thoroughfares within its limits.

Beverly has long been one of the most

Hale, Bow and many other streets were improved.

At the present time the street building forces are excavating and putting in the macadam foundation for a portion of Bridge Street, approximately  $\frac{3}{4}$  of a mile in length, and extending from Beverly proper toward the town of Danvers. Other streets also are



TYPICAL RESIDENTIAL STREET IN BEVERLY, MASS.

popular of Massachusetts resorts, and during the Taft administration was the summer capital of the country. Located 20 miles from Boston, it has a population of approximately 30,000. Scores of beautiful country estates surround the town, and the motor traffic, particularly in the summer months, is heavy.

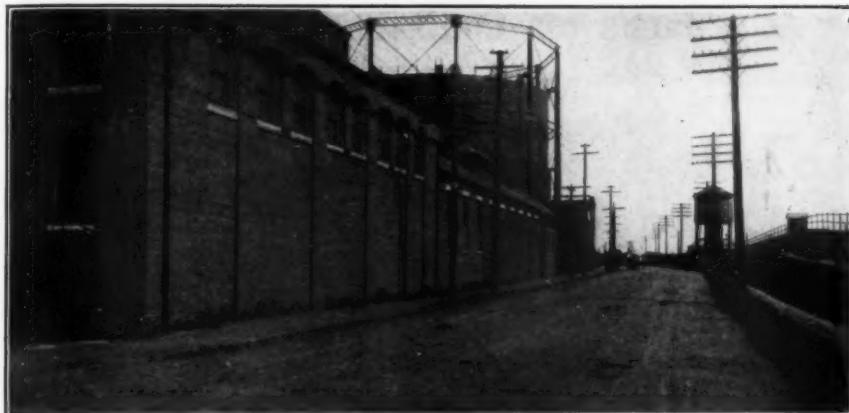
The first penetration macadam highway in the town, constructed with Bermudez road asphalt, was laid nine years ago, during the administration of Mayor Dodge. Since that date, under four different administrations, the extension of asphalt roads has continued steadily, until to-day Beverly is known throughout New England, and to hundreds of motorists from other sections, as a town of good streets. A portion of River Street was first improved in 1912, the Beverly Street Department conducting the operation. In the succeeding years, Essex, Dane,

scheduled for improvement during the next few months.

### Construction Methods

The general plan of construction followed is the same for all Beverly highways. Excavation is made in the usual manner. Then the subgrade is rolled and compacted. The foundation course of broken stone, of an average thickness of 6 inches after ultimate compaction, is then spread.

Upon the foundation course a 3-inch wearing surface of stone,  $1\frac{1}{2}$  to  $2\frac{1}{2}$  inches in diameter, is spread. This course is shaped and rolled sufficiently to key the stone. Two gallons of Bermudez road asphalt are then applied per square yard, in the main pouring application. The surface is covered immediately with a thin layer of chestnut stone  $\frac{3}{8}$  to  $\frac{5}{8}$  inch in diameter, and the highway thoroughly rolled. The



**RIVER STREET, BEVERLY, MASS., BUILT BY PENETRATION METHOD IN 1912**  
This road has a 4-inch macadam base and a 3-inch wearing surface. The asphalt was poured by hand.  
No maintenance has been necessary, and the street is reported in good condition to-day

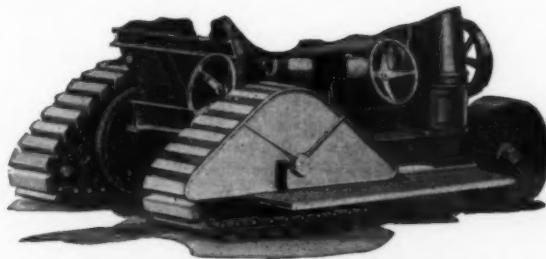
chestnut stone under the rolling is forced between larger stone of the wearing surface, filling any voids. After the rolling, a seal coat consisting of  $\frac{1}{2}$ -gallon of asphalt per square yard is spread, and covered with clean screenings.

No appreciable maintenance has been charged against any of the penetration roads; even River Street remains in perfect condition to date.

To James W. Blackmer, Commissioner of

Public Works, is due in large measure the credit for the excellent condition of Beverly streets. The Commissioner has personally supervised the construction of the major portion of the macadam roads, holding his office under Mayors Dodge, McDonald, McPherson and Tuttle. He has insisted upon care and judgment, and throughout his term has had the coöperation of a conscientious Highway Committee in facilitating proper street construction.

## Traction Tread in Demand for Pavers



THE T. L. SMITH COMPANY HAS ADOPTED THIS TYPE OF  
TRACTION TREAD FOR ITS CONCRETE PAVING MIXERS  
TO KEEP THEM ALWAYS MOBILE

## Jacks for Contracting Service

**A**N all-steel jack, made in sizes ranging from 15 to 100 tons, each having a standard lift of 10 inches, has been placed on the market by the McKiernan-Terry Drill Company, 19 Park Row, New York City. This jack, known as the "Doughboy," is remarkably strong and light and is designed for the class of work usually done by hydraulic and gear-operated screw jacks. The smaller "Doughboys" are strictly one-man jacks, as one man can carry them anywhere and can lift the rated capacity with a 24-inch handle without the use of a piece of pipe for additional leverage. Each of the six sizes weighs about one-half as much as other jacks of equal capacity.

The supporting column, outer casing and screw are made of seamless cold-drawn tubing having a tensile strength of 80,000 pounds per square inch. The column is electrically welded to a drop-forged base, and the cap is also drop-forged. The nut within which the lift screw turns is made of phosphor bronze, and the worm gear is made of machine steel, hardened and ground. The load is carried on roller bearings, and lubrication is effected through an oil hole in the cap which oils the screw, nut and roller bearing. The worm gear is lubricated through two oil holes in the worm gear housing. This jack is furnished in either worm gear or bevel gear type. The worm gear type is recommended, because, while it is somewhat slower than a bevel gear jack, it is easier to operate. The worm gear type requires 12 revolutions of the worm shaft to raise the cap one inch.

One of the features of this "Doughboy" jack is the absence of rotation under load. The outer casing telescopes the column and is positively prevented from turning by two flat sides on each tube. A load can therefore be lifted on the toe without possibility of rotating and throwing the load. A positive check to prevent over-travel of the screw is provided by an outside upset at the top of the tubular column and an inside upset at the bottom of the tubular



THE DOUGHBOY JACK

casing. When these two projections engage, further movement of the screw is impossible and damage to the screw or thread is positively prevented. The jack can be elevated to one-thousandth part of an inch and remain elevated under load for any length of time without backing down. Its reliability in this respect makes it particularly valuable in delicate shoring operations.

## New Road Maintainer

**A** NEW machine which has just been put into the road maintainer field and is already creating favorable interest is a one-man outfit departing entirely from familiar design. It is built with one front wheel and with two large drive wheels in the rear, the grader blade being swung underneath and in front of the operator, giving him a chance to see what he is doing.

The only purpose of this machine is the proper and economical maintaining of dirt roads through the continuous system of road patrol maintenance, started in Wisconsin and rapidly spreading to all parts of the country.

Good roads are the greatest single factor in

securing and maintaining community prosperity. Last year the sum of \$300,000,000 was lost by farmers in marketing (or being unable to market) their products over bad roads. Roads that are impassable during part of the year cost farmers in every community thousands of dollars a week.

Hard roads, brick, concrete or macadam roads are excellent all-year roads. We should have more of them. But it is impracticable to pave every country road. And it is just as important to have good laterals leading to the main roads as it is to have hard main roads themselves. Every county and township not only wants but needs roads that are passable



## Maintaining Park Roads

As a result of careful planning to attain the "City Beautiful," most main arteries of travel from one section of a city to another is through its parks, this produces very heavy traffic.

Quite often, parks containing hundreds of acres had their beginning in just a small plot of ground; additions were made, the management changed frequently, and as a consequence one single park may contain almost every kind of road.

To be able to repair the various roads, a large amount of equipment is required.

*The beautiful parkway shown above constructed of*

### STANOLIND PAVING ASPHALT, "C"

has been in use for over 5 years, and at the present time it is in perfect condition, without one cent having been spent for maintenance.

We believe that no better kind of roadway for parks was ever devised than those of asphalt.

Our booklet "Stanolind Paving Asphalt" containing information regarding this type of road as well as all other asphaltic roads will be mailed free upon request.

STANDARD OIL COMPANY  
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910 So. Michigan Ave.

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all the year around, and roads that will allow communities to get to and from each other quickly and economically. In a township 6 miles square, if it is laid off in sections, there are 72 miles of roads, and it can be readily seen that it is impractical, if not impossible, to pave all the country roads, at least for some time. The proper maintenance of dirt roads therefore is the only solution.

The one-man outfit shown here, made by the Avery Company, Peoria, Ill., is more economical than a horse outfit because of its greater speed and because with its 6-cylinder motor developing 8 horse-power on the blade it replaces two or three teams of horses and two or three men. Anyone, without previous experience, capable of driving an automobile or a tractor can operate this machine successfully. The operator sits at the rear of the tractor with the blade in front of and below him, so that he is sitting in a comfortable, natural position and can see exactly what work is being done. The blade attachment is 12 feet long and is swung at an angle underneath the machine on a sub-frame which is bolted to the main frame. The blade itself, made in three sections, two 5 feet in length and one  $2\frac{1}{2}$  feet, is adjustable both to the curvature of the road and the depth of the cut.

As the blade angles between the rear of the left drive wheel and the front of the right, it makes a cut 9 feet 6 inches wide. The outside right-hand blade is the  $2\frac{1}{2}$ -foot blade and is placed in a more angular position. In operation it thus keeps the dirt away, rolling towards the center. This blade is especially convenient in cleaning out ditches or gutters.

In crowning a road the center of the blade is raised, and the dirt will then roll to either side, leaving a smooth, perfectly crowned highway or street. Four levers, within easy reach of the operator, control the three sections of the blade quickly and easily, so that no matter what the condition of the road may be, it can be crowned properly, and the right drainage can be secured in one or two rounds.

This machine may also be used for hauling loaded wagons, in construction work, or hauling scrapers and other road machines used in highway maintenance. It can also be equipped with a belt pulley for operating a small rock crusher or other belt machines, if desired. The outfit turns in a very short space, thus enabling the operator to cut close to trees, culverts, bridges, etc.

The powerful 6-cylinder motor has a 3-inch bore and a 4-inch stroke and develops sufficient power for pulling the blade to any depth desired. With the three-speed transmission, giving a large variation in speed, it is possible to go over the road slowly when it is rough, and faster as it becomes smooth. With the use of such a one-man road maintenance outfit, the country roads and city streets can be kept smooth and in the best possible condition twelve months in the year. This machine is especially adapted to a township where the road patrol system of continuous maintenance is in operation—a system which because of its great merit is rapidly coming into general use.

Recently an ordinary horse-drawn maintainer worked ten blocks of dirt streets in competition with this one-man road maintainer. The horse-drawn outfit had not cut out the



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Calculation M

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with a Monroe**

FOR example, take an ordinary problem in sewer design. Given rainfall 2 in. per hour in a well paved compactly built city. What size circular sewer would be necessary to accommodate 20 acres with a 2% average grade?

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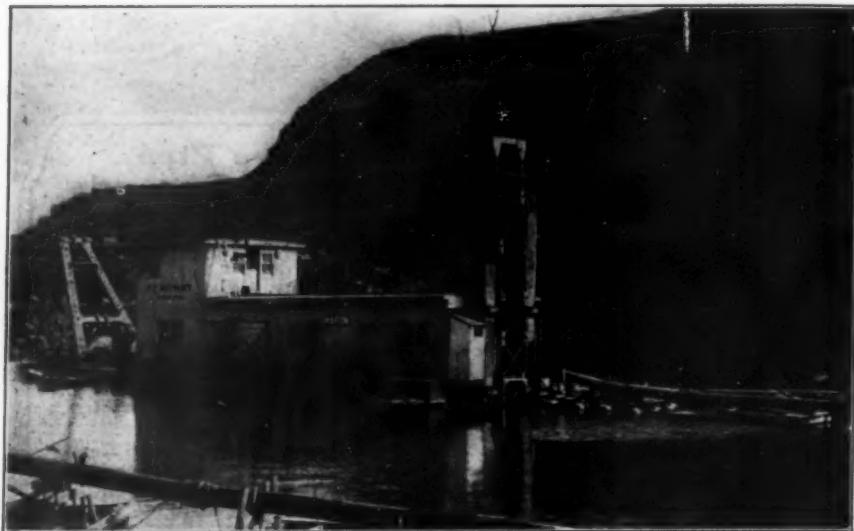


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gutters; it had not filled up the ruts and low places. It merely peeled off the top of the ground. With the one-man motor maintainer, ten blocks were worked in 1 hour and 50 minutes. The gutters were cut out, the road was crowned and leveled the full width, all the low places were filled in, and the high ones cut off.

When finished the street looked more like a carefully raked garden than anything else—perfectly "guttered," leveled and crowned.

And instead of tearing down and putting up this street, subsequent traffic has simply perfected the work begun by the one-man motor maintainer.



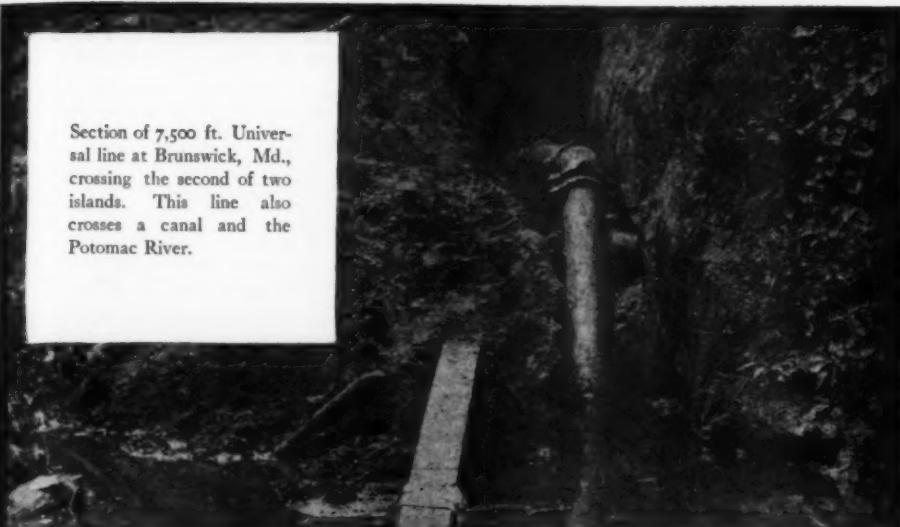
AN ELECTRICALLY EQUIPPED MARION HYDRAULIC DREDGE OPERATED BY  
P. T. McCOURT, AKRON, OHIO

## An Electrically Equipped Hydraulic Dredge

IN 1915, the Otis Steel Company, Brooklyn, Ohio, reclaimed some valuable land and straightened the channel of the Cuyahoga River. At the point where this work was carried on, the river makes a bend about the foot of a range of hills, the bend being in the form of a semi-circle about one mile in diameter, going around a tract of land of about 350 acres. Through the new channel this area was made available for more buildings for the steel company. The work of excavating and filling was let to P. T. McCourt, contractor, Akron, Ohio, who decided to cut down the hill on this elevation with steam shovels and to excavate the new channel with a hydraulic dredge. The work was started on the hill in the spring of 1914 with two Marion Model 60 steam shovels, using dump-cars to deliver the excavated material to various points for fill.

The hydraulic dredge for this work, shown in the illustration, was of a special design and

built complete by the Marion Steam Shovel Company, Marion Ohio. The hull is 80 feet long, 25 feet wide and 5 feet deep, built of steel throughout. The frames of the hull run cross-wise and consist of channels, top and bottom, with vertical angles connected thereto by gusset plates. Two fore and aft trusses provide the necessary longitudinal stiffness, these trusses being connected directly to both the top and bottom members of the cross-frames. All plating for the bottom, side and deck is laid fore and aft, the after part of the deck between the trusses being cut out to form a cockpit for the dredging pump. The bow and stern gantries are also of steel. In the pilot house, located on the top of the fore and aft trusses, are located the winch levers, gages, switchboards and all controlling apparatus, so that the entire operation of the dredge is controlled by one man. All machinery is driven by 3-phase, 60-cycle, 2,200-volt, General Electric



Section of 7,500 ft. Universal line at Brunswick, Md., crossing the second of two islands. This line also crosses a canal and the Potomac River.

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motors, the variable speed motors being of the slip-ring type equipped with 14-point reversing controllers. The current is brought on board by a flexible marine cable connected to transmission lines running parallel to the cut.

The dredging pump has 16-inch suction and discharge openings and is direct-connected by means of a flexible insulated coupling to a 300-horse-power motor, mounted on the same bed plate. The pump delivers 225 cubic yards of solid material per hour through 1,000 feet of discharge pipe, and to an elevation of 12 feet above the water line, when running at 345 revolutions per minute. Owing to the great variation in the length of the discharge pipe line required at various times, the motor is provided with controlling apparatus for running continuously with 25 per cent speed reduction.

A 2-inch hydraulic giant was mounted on the front of the dredge to knock down part of the material and sluice it into the cut ahead of the dredge. Water for this giant is provided by a 6-inch, 3-stage Worthington turbine pump, de-

livering 1,300 gallons per minute at a head of 360 feet, and direct-connected to a 200-horse-power motor operating at 1,140 revolutions per minute.

A 5-drum winch, driven by a 20-horse-power motor, is used for handling the swinging lines, raising the cutter ladder and operating the spuds. The motor is provided with controlling apparatus for any variation in speed from full speed down to half speed and is also fitted with solenoid brake. The motor is direct-gearred through intermediate shafts to the drum shafts, and each drum is provided with internal expanding friction and outside brake bands, each one of which is separately controlled from the pilot house.

The channel was cut 8 feet deep and 150 feet wide. After completing this job the dredge was temporarily laid up and the cabin and engine were badly damaged by fire. It was later rebuilt, put into service and sold to the Cleveland Engineering Company for use in other dredging operations.

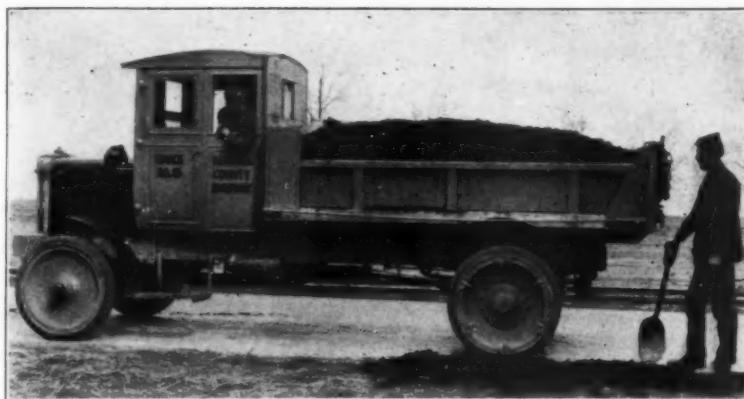
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A COUPLE GEAR FREIGHT WHEEL COMPANY TRUCK USED IN NEW YORK CITY,  
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Dependability is the keynote of its service.

"But in spite of this strenuous hauling" says Commissioner Herzog, "our Winther has cost us practically nothing. \$14.44 represents its total repair bills for the past year. Fuel and lubricating expenses have been in the same moderate proportion."

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### Winther Motor Truck Company

*Manufacturers of Motor Trucks and Motor Cars*

Kenosha, Wis.

# WINTHER TRUCKS

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THE need of adapting excavators to a greater field of work has led Pawling & Harnischfeger Company, Milwaukee, Wis., to put out a shovel attachment which may be applied to any 205- or 206-K.C. excavator which this company has built. The new parts required are a dipper and dipper handle, a boom, a boom foot socket casting, one thrusting shaft complete, one operating lever bearing, a break treadle with ratchet and the necessary levers for it, one thrusting chain and a set of boom swing braces.

The dipper is constructed with a steel plate shell, steel plate front, lip and door with an annealed steel casting back, and forged teeth with hardened points and forged hinges. The dipper is of  $\frac{1}{2}$ -cubic yard capacity. The dipper handle consists of two members designed to straddle the boom, each member having an oak core, armored with steel plates on all four sides. The dipper handle racks are manganese steel castings and the end is a single steel casting. The braces are steel forgings, and all pin joints on both the dipper and the handle are bushed with hard steel bushings.

The boom is of structural steel plates, and shapes in the form of a box section, so designed that all the rivets are driven from the outside and are easily reached. The boom foot is



AN EXCAVATOR CONVERTED INTO A SHOVEL

a single annealed steel casting, securely riveted to the structural steel member.

The thrusting shaft interchanges with the forward drum shaft of the regular machine. It is provided with a sprocket, loosely mounted on the shaft for operating the shipper shaft thrust. Suitable mechanism is provided to enable this sprocket to be rotated in either direction for thrusting out or drawing in the handle. The shovel attachment is operated by the standard levers on the machine, with the exception of an additional brake attachment to one of the brake treadles. This attachment can be quickly removed in case it is desired to reconvert the machine back into a drag-line or for operation with a clam-shell or other type of bucket.

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This machine will be sold at a bargain and any contractor having shallow ditch work under consideration would do well to look into this proposition before starting.

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do all the work. They load 60 cu. yds. per hour, at a power cost of 1 cent per cu. yd. or less. Think for a moment what this means to

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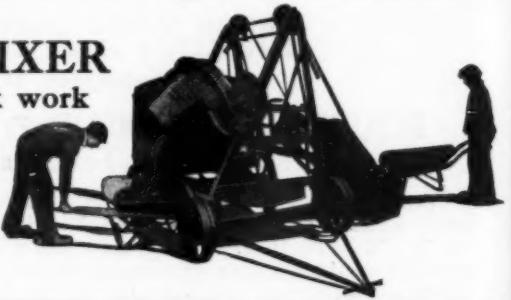
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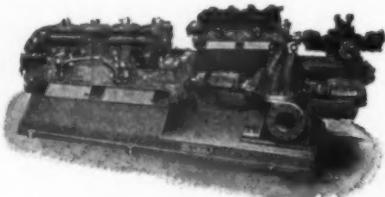
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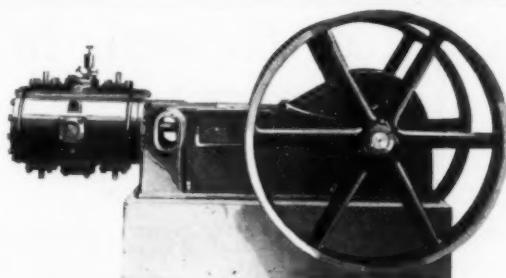
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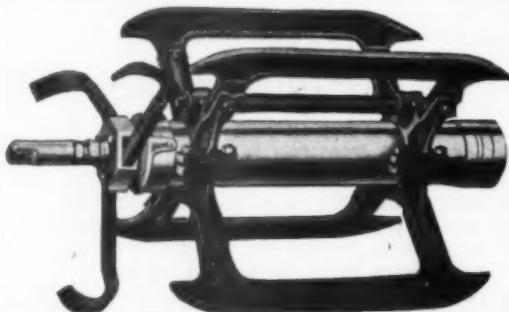
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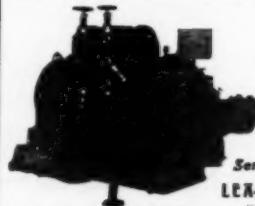
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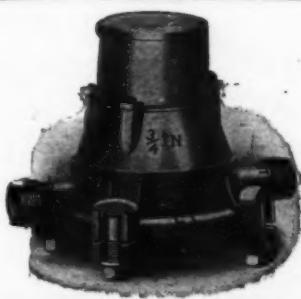
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South Bend Indiana

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Paper Insulated Cable  
Round Conductor  
Cables  
Sector Cables



## INDEX TO ADVERTISERS

After referring to the "Where to Purchase" Section, on pages 3 to 37, if you will look up the advertisements as per index below, you will be able to secure further data (with illustrations in many cases) on the material or equipment relative to which you are seeking information.

Acme Road Machy. Co. ....	10	Gamon Meter Co. ....	92	Otterson Auto Educator Co. ....	88
Allis-Chalmers Mfg. Co. ....	86	General Electric Co. ....	96	Owen Bucket Co. ....	6
Alpha Portland Cement Co. ....	83	General Motors Truck Co. ....	99		
American Steel & Wire Co. ....	81	Good Roads Machinery Co. ....	24		
American Well Works ....	86	Granite Pav. Block Mfrs. Assn. ....	85		
Austin-Western Road Machy Co. ....	28	Gray Iron Foundry Co. ....	6		
		Grinnell Co. ....	88		
		Habirshaw Electric & Cable Co. ....	97	Pacific Flush-Tank Co. ....	88
Badger Meter Mfg. Co. ....	93	Hains Mfg. Co., Geo. ....	79	Packard Motor Car Co. ....	79
Baker Mfg. Co. ....	22	Hauck Mfg. Co. ....	6	Pawling & Harnischfeger Co. ....	14
Barber Asphalt Paving Co. ....	100	Hazard Mfg. Co. ....	96	Payne Dean Limited ....	89
Barrett Company, The ....	82	Heil Co., The ....	22	Pennsylvania Cement Co. ....	80
Best Tractor Co., C. I. ....	83	Heitzel Steel Form & Iron Co. ....	10	Pioneer Asphalt Co. ....	18
Bissell & Co., F. ....	94	Hershey Manufacturing Co. ....	90	Pitometer Co. ....	92
Briggs, Inc., Marvin ....	77	Hollow Building Tile Assn. ....	82	Pittsburgh-Des Moines Steel Co. ....	36
Bucyrus Co. ....	30	Holt Manufacturing Co. ....	81	Pittsburgh Filter & Eng. Co. ....	90
Buffalo Meter Co. ....	92	Indians Air Pump Co. ....	90	Pittsburgh Meter Co. ....	93
Buffalo-Springfield Roller Co. ....	22	International Motor Co. ....	83	Porter Co., H. K. ....	16
Builders Iron Foundry ....	93			Ransome Concrete Machy. Co. ....	38
Burch Plow Works Co. ....	16			Rochester Can Co. ....	94
Busch-Sulzer Bros.-Diesel Eng. Co. ....	84			Rundle-Spence Mfg. Co. ....	94
Carey Co., Philip ....	82	Jaeger Machine Co. ....	80	Sargent Lumber Co. ....	22
Central Foundry Co. ....	73	Keappler Boarding & Com. Co. ....	78	Semet-Solvay Co. ....	80
Clark Co., H. W. ....	93	Kelly-Stephens Tire Co. ....	83	Simplex Valve & Meter Co. ....	90
Cleveland Tractor Co. ....	32	King Mfg. Co. ....	96	Simplex Wire & Cable Co. ....	96
Coldwell-Wilcox Co. ....	84	King, Philip T. ....	77	Smith Mfg. Co., A. P. ....	89
Conklin & Harrington, Inc. ....	79	Kinney Mfg. Co. ....	26	Standard Oil Co. of Indiana ....	69
Country & Co. ....	36	Koehring Co. ....	8	Standard Scale & Supply Co. ....	37
Crane Co. ....	89	Kolesch & Co. ....	94		
Craven Co., Frank T. ....	77	Koppal Indus. Car & Equip. Co. ....	16	Texas Company, The. ....	1
Cutter Works, George. ....	97			Thew Shovel Co. ....	30
		Lea-Courtenay Co. ....	92	Thomson Meter Co. ....	92
De Laval Steam Turbine Co. ....	86	Lee Trailer & Body Co. ....	80	Tiffin Wagon Co. ....	81
Delaware Clay Products Co. ....	37	Lithoprint Co. of New York. ....	94	Truscon Steel Co. ....	36
Dixon Crucible Co., J. ....	94	Littleford Bros. ....	81	Turbine Sewer Mch. Co. ....	88
Dow Chemical Co. ....	82	Ludlow Valve Mfg. Co. ....	84		
Duff Mfg. Co. ....	20	Lynchburg Foundry Co. ....	84	Union Metal Mfg. Co. ....	97
Du Pont de Nemours & Co., E. I. ....	85-95			Union Water Meter Co. ....	92
Dustoline for Roads Co. ....	78	Mariion Steam Shovel Co. ....	30	United Iron Works, Inc. ....	90
		Mathieson Alkali Wks., Inc., The. ....	36	United States Shipping Board. ....	79
East Jersey Pipe Co. ....	88	McGraw-Hill Co. ....	2	Universal Road Machinery Co. ....	18
Electric Railway Equipment Co. ....	96	McKiernan-Terry Drill Co. ....	12		
Engineering News-Record ....	2	Midwest Engine Co. ....	85	Wallace & Tierman Co., Inc. ....	34
Equitable Asphalt Maint. Co. ....	10	Monroe Calculating Machine Co. ....	71	Waring-Underwood Co. ....	16
Erie Machine Shops. ....	82	Mueller Mfg. Co., H. ....	89	Warren Bros. Co. ....	83
		Municipal Supply Co. ....	10	Western Wood Pipe Pub. Bureau. ....	95
Fairbanks, Morse & Co. ....	88			White Co., The. ....	80
Fairfield Engineering Co. ....	40	National Hoisting Engine Co. ....	18	Weiss, B. M. ....	77
Federal Motor Truck Co. ....	81	National Meter Co. ....	93	Wickes Bros. ....	94
Ford Meter Box Co. ....	90	Nat'l Water Main Cleaning Co. ....	85	Winther Motor Truck Co. ....	75
Forsythe Bros. ....	78	Neptune Meter Co. ....	91	Winton Improvement Co. ....	78
		Newport Culvert Co. ....	4	Wood & Co., R. D. ....	84
		Nordberg Manufacturing Co. ....	86	Worthington Pump & Mchly Co. ....	87
		Northern Fire Apparatus Co. ....	90		
		Norwood Engineering Co. ....	84	Yeomans Bros. ....	84
				Zelnicker Supply Co., Walter ...	78

Manufacturers who advertise in alternate issues may not appear in the above INDEX, but are carried in bold face type in the WHERE TO PURCHASE section at the front of this magazine. Readers wishing catalogs or further information regarding the products of these manufacturers should write to the CATALOG DEPARTMENT, CONTRACTORS' & ENGINEERS' MONTHLY, TRIBUNE BUILDING, NEW YORK CITY.

38  
6

18

19

14

19

10

14

8

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8

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**GENERAL MOTORS TRUCK CO.**

Pontiac, Michigan

*Branches and Distributors in principal cities*



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### Built to end macadam roller troubles

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Every working part of the New Iroquois Macadam Roller is a separate unit resting on a steel frame and *supporting no weight but its own*. Rack and strain are eliminated and repairing made easy and inexpensive.

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